STUDIES ON TAXONOMY OF SOIL AND PLANT PARASITIC NEMATODES

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D E D I C A T E D

TO

MY

FATHER AND MOTHER

IN

GRATITUDE.

A C K N O W L E D G E M E N T S

The author wishes to express his sincerest gratitude and appreciation to Dr. Abrar M. Khan, M.Sc., Ph.D., (Minn.) for his help and guidance during the progress of this work, without which this would have never come to light.

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I N T R O D U C T I O N

Plant diseases caused by unfavourable weather, fungi, bacteria, insect pests, viruses and nematodes have been the greatest obstacles to man's efforts to feed and clothe himself. The last category of disease causing agent has received very little attention because of their small size and the habitat which is invariably soil around the roots of the plants.

Shakespeare (1594) unwittingly gave us what may be called the first recorded evidence of plant parasitic nematodes when in "Loves Labour's Lost", he wrote, "Sowed Cockle reap'd no corn". Nematology had its beginning in the latter half of the 18th Century when Needham, (1745) reported the presence of a nematode in the galled wheat kernels. It was left to Roffredi (1775-76) who proved the causal nature of the nematode which was found associated with 'Cockle disease' of wheat by Needham thirty years earlier.

Research on plant nematology had really its begining in the second half of the nineteenth century. Raski (1958) has rightly choosen 1845 as the starting date for nematology as in that year Dujardin described two of the important genera, viz., Dorylaimus and Rhabditis. It was followed by the work of Bastian (1865) and

Butschli (1873). The latter is credited with the discovery of some of the morphological characters that are used even today. It was immediately followed by De Man, whose research works expanded over a long period, starting from 1884 to 1930. The accurate description of many species, supplemented with excellent illustrations and some of the morphological concepts which De Man had developed had not undergone much change and had withstood the test of time. Others who contributed during this period on free-living and plant parasitic nematodes such as sugar beet nematode, pea-root nematodes, stem and bulb nematodes and foliar nematodes included-Berkeley (1855), Schacht (1859), Kuhn (1869-81), Schmidt (1871), Orley (1880) Treub (1885), Goeldi (1887), Strubell (1888), Liebscher (1892) and many others.

In the U.S.A., plant nematology had its begining in the second half of the present century when Cobb in 1914 published part-I of his works entitled, "Contribution to a Science of Nematology". To his credit not only goes the name "Nematology" which he suggested to this developing discipline, but also some of the techniques, such as, sampling soil for nematodes, wet screening for separating the nematodes, killing, fixing and mounting of the nematodes. Cobb had a special knack for developing and refining techniques as a result of which he was able to demonstrate quite a minute structures, such as phasmids, deirids, amphids and cephalic papillae. The presence of these structures became a reality when

he devised techniques for cutting en face views. These structures are used even today in differentiating genera and species.

Scientists like Filipjev (1889-1937), T. Goodey (1888-1953), Steiner (1886-1961), Micoletzky (1883-1929), Fischer (1894), Menzel (1914,17,20,29 and 29), Godfrey (1923-34), Chitwood (1931,33,37,49,57 and 59), De Coninck (1931,35,39,43 and 45), Christie (1932,33,36,38,39,42 etc.), Taylor (1936), Thorne (1936,39,41,49,65 etc) and Allen (1940,41,52,55,57 etc) have also greatly contributed to this developing science. New and improved techniques and revitalized interest in many countries immediately after world war-II infused a new spirit and Nematology grew by leaps and bounds. A number of active centres developed in the U.S.A., U.K., The Netherlands, Germany, Canada, U.S.S.R., and Hungary. At these centres research expanded and Nematology was no longer a science dealing with taxonomy and morphology only, but nematodes were treated in an all inclusive way, embracing histology biochemistry, ecology, physiology, cytology and genetics. It had been during this period that evidence for nematode pathogenecity (Gadd and Loos, 1941 and Birchfield and Martin, 1956); evidence for production of toxins by nematodes (Linford, 1939 and Myuge, 1956 effect of root leachates on the hatching of larvae (Gadd and Loos, 1941 and Linford, 1939); development of certain chemicals having nematicidal value (Ellenby, 1951 and Chitwood, 1952); application of tissue culture technique to culture nematodes under aseptic

conditions (Mountain, 1955 and Krusberg, 1961); interaction between nematodes fungi and bacteria (Smith & Taylor, 1941 and Crosse and Pitcher, 1952); and nematodes acting as vectors of some of the soil borne viruses (Hewitt, Raski and Goheen, 1958), had been obtained. Another important event of great historical importance was the appearance of a journal, "Nematologica" devoted exclusively to nematological papers and broad and enlightened policy of many other journals to provide space to papers dealing with the applied aspects of Nematology. The creation of Societies like "Society of American Nematologists" and "Society of European Nematologists" had also been an important event.

It is not too difficult to trace the development of nematology in India because it has not yet been recognised as a separate discipline. It is assigned either to Plant Pathology or to Entomology departments in different institutions. The first recorded evidence on plant parasitic nematodes came from this country when Butler (1913) described "Ufra" disease of rice from Bengal, caused by Ditylenchus angustus (Butler, 1913) Filipjev, 1936. Cobb (1913) described a few species of plant nematodes associated with the roots of trees in Bangalore. Some other important plant parasitic nematodes like Anguina tritci (Steinbuch, 1799) Filipjev 1936; Nothanguina cecidoplastes (T. Goodey, 1934) Whitehead, 1959; Meloidogyne spp. Heterodera spp.

and Aphelenchoides ritzema-bosi (Schwartz, 1911) Steiner,1932 have also been reported from this country.

It is, therefore, clear that there has been a considerable gap between the excellent papers published by Butler and some of the developments which have taken place in recent years. At the instance of Dr. Abrar M. Khan, the visit of Mr. F.G.W. Jones and Dr. D.J. Raski was arranged by the British Council and Rockefeller Foundation respectively. During his short stay at Aligarh Mr. Jones exploded the myth "cyst forming species are characteristi of the more temperate regions of the world", when he reported Heterodera rostochiensis Woollenweber, 1923 from India. The interest invoked by Dr. M.A. Basir and his associates in the department of Zoology in taxonomy and on applied aspects by the department of Botany of Aligarh Muslim University, Aligarh, and the Seminar organised by the Rockefeller Foundation and I.C.A.R. in which some eminent Scientists like Mr. F.G.W. Jones, Dr. J.B. Goodey and Dr. D.J. Raski were invited have richly contributed in the establishment of plant nematology on firm footing. So far the studies were confined only to the hatching and the host-range of Meloidogyne species (Ahmad and Khan, 1960,61,64) Chattopadhya and Sen Gupta; Pushkarnath and Chowdhuri, 1960; and Dhande and Sulaiman, 1961), but now the

plant nematology has entered into an era where a large number of institutions are actively engaged in studying the various aspects of nematodes. Schemes on vegetable crops and the Golden nematode have been sanctioned by PL-480 and I.C.A.R. at Aligarh and Coimbatore respectively. In recent years a large number of spear bearing nematodes have been described by scientists of this country. The information about the nematodes described till 1962 has been compiled up by Khan et al, 1964. Those who have contributed to the knowledge of taxonomy of nematodes of India are Das (1960) Siddiqi (1959-65), Jairajpuri (1963-65), Khan, E. (1963-64), Khan and Basir (1964-65), Edward and Misra (1964-65) and Raski, Prasad and Swarup (1964).

Several thousand spear bearing nematodes have so far been described and there may be many more which await description. It is most unfortunate that taxonomic work is treated with contempt which probably it does not deserve. It had been true to a certain extent that taxonomy of nematodes had been in a state of confusion for a considerably long period. The small size of nematodes, their body make-up and overzealousness on the part of individual Scientists in describing new species on insufficient number of specimens greatly contributed towards the confusion. Julian Huxley, Rensch, Mayr, Remane, Simpson and other outstanding evolutionists have given a new meaning to

taxonomy and systematics. The statement that "Taxonomy is alpha and Omega of Biology" is true to a very great extent. The success of control measures against plant parasitic species depends much upon the correct diagnosis of the parasitic forms.

It was with this aim in view that the present work was undertaken. The entire work presented here is divided into two parts.

PART-I: It deals with the morphology and taxonomy of the order Tylenchida which includes the description of one new genus, one new subgenus, thirty three new species and few new records and new combinations.

PART-II: It deals with the order Dorylaimida and includes the description of one new genus, twenty new species and some new records.

MATERIALS AND METHODS

Collection of Soil samples.

For surveying the spear-bearing nematodes, the soil and root samples of a variety of plants including grasses, weeds, ornamentals, vegetables, crop plants and fruit trees were examined, principally from Aligarh. Soil samples from Nainital, Mussoorie, Dehradun and Bijnor (Uttar Pradesh), Karauli (Rajasthan); Srinagar (Kashmir) and Cuddalore (South India) were also examined. Soil samples from around the roots of plants and fine root pieces were collected at the depth of six inches to two feet depending upon the type of plant under investigation. While studying the nemic fauna of a particular field, soil samples were collected from a number of sites and later mixed. In each case soil was kept in a polythene bag and the information pertaining to each with respect to the host, locality, soil type and the date of collection was tagged to the bags. The bags were stored in a cabinet running at 15-20^{o}C.

Processing of Samples.

Soil from the bag was transferred into a bucket and tap water was poured. The soil was then rinsed, thoroughly mixed and the lumps, if any, were broken. The suspension was then allowed to

settle for about ten seconds after which it was poured through a 25 mesh sieve into another bucket. The residue left on the sieve was discarded. The filterate so obtained was passed through the 52 and 300 mesh sieves in the manner described above and the residues left on these sieves were collected in separate beakers of 100 ml capacity with the help of wash bottle.

Isolation of Nematodes.

Since the suspension obtained even from 300 mesh sieve was not clear, it was, therefore, poured onto a green filter paper No.50, mounted on a coarse supporting sieve, contained in a large petridish for about 24 hours. The amount of water added prior to the transfer of suspension was just enough to touch the bottom of the filter paper. Thereby the suspension became clear and by this method the recovery of active nematodes was quite high.

To search for non-active forms the suspension obtained earlier or residue left on the filter paper was examined.

Killing and Fixing.

The nematode suspension was transferred to a beaker of 50 ml capacity and left undisturbed for 1-2 hours. This allowed the nematodes to settle. Later, the excess water was decanted and a concentrated suspension was obtained. The beaker was then transferred to an incubator running at 55°C for 5-7 minutes depending upon the amount of water present in the beaker. An equal amount of warm double strength T.A.F. was added to the beaker

Mounting and Sealing.

Live specimens, temporary water and T.A.F. mounts were examined. The permanent mounts were prepared by gradually removing the nematodes from the fixative to dehydrated glycerine. The nematodes were transferred to a drop of dehydrated glycerine placed on a glass slide or on a cover glass if Alluminium slide holders were used and glass wool pieces of nearly the size and width of nematodes were arranged at three angles and then the cover slip was placed. For temporary mounts sealing was done with nail polish, whereas, for permanent mounts glyceel had been used.

Observations.

Live nematodes were always first examined under the binocular as many genera and species could easily be recognised by their movement, appearance and in certain cases by their intestinal contents e.g. Diphtherophora.

For measurements of the worms De Man's modified formula had been used. An explanation of letters used, is given below:

L = The total body length of the worm in mm.

a = The total body length of the worm divided by maximum body width.

b = The total length of the worm divided by the length of its oesophagus.

c = The total length of the worm divided by the length of its tail.

V= The position of vulva from the anterior end of the body expressed in terms of percentage of the total body length. The superior figure indicates the extent of the ovary from the vulva.

T= The extent of the male gonad from cloaca expressed in terms of percentage of the total body length.

The type material had been deposited with the Plant Pathology Section of the department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

The paratypes of Basiliophora indica n.gen., n.sp. B. jonesi n.gen., n.sp., Ecphyadophora goodeyi n.sp., Ecphyadophora tarjani n.sp., Boleodorus hyderi n.sp., Rotylenchulus stakmani n.sp., have been deposited in the nematode collection of Beltsville, Maryland U.S.A. and of Heterodera mothi and Seinura nagini at Rothamsted Experimental Station, Harpenden, Herts. Some paratype specimens of Rotylenchulus stakmani n.sp. have been deposited in the nematode collection of Riverside California. Some portions of this thesis have already been published which have been reproduced here with the permission of the University.

PART - I.

INTRODUCTION TO THE ORDER TYLENCHIDA

The order Tylenchida includes some of the most important plant pests. Anguina tritici (Steinbuch, 1799) Filipjev, 1936, the first described plant parasitic nematode, also belongs to this group. Here in are included nematodes showing all types of parasitism. Members of Criconematidae are sedentary ectoparasitic, Xiphinema, Longidorus and Trichodorus species migratory ectoparasitic; Members of Hoplolaimidae and Tylenchorhynchus species migratory semi-endoparasitic; Rotylenchulu and Tylenchulus species sedentary semi-endoparasitic; Pratylenchus Radopholus, Hirschmanniella, Ditylenchus and Aphelenchoides species migratory endoparasitic and Anguina, Heterodera, Meloidogyne and Nacobbus species are sedentary endoparasitic.

Taxonomically the order Tylenchida constitutes quite a diversified assemblage of nematodes ranging from the slender vermiform (Tylenchus, Hoplolaimus, Pratylenchus and Criconemoides etc.) nematodes to the saccate, pyriform or lemon-shaped (Rotylenchu Nacobbus, Heterodera and Meloidogyne etc.) nematodes.

Since the publication of the works of Sher (1961,62,65), Goodey (1963) and Siddiqi (1964), the systematics of this order, as proposed by Thorne (1941,49,61) has undergone quite a bit of a change. It now includes two superfamilies Tylenchoidea and Aphelenchoidea and twelwe families namely Tylenchidae, Neotylenchidae, Hoplolaimidae,

Pratylenchidae, Criconematidae, Fergusobidae, Heteroderidae, Tylenchulidae, Aphelenchidae, Aphelenchoididae, Anomyotidae, Paraphelenchidae, and many subfamilies dealing with plant parasitic forms.

There appears to be a gradual evolution within the family Tylenchidae with regard to the character of cephalic-framework, starting with the genera like Psilenchus, Macrotrophurus Tylenchus and Basiria lacking head sclerotization to the genera Trophurus, Pseudhalenchus and Ditylenchus with weak sclerotization leading to the genera Tylenchorhynchus and Telotylenchus with conspicuous sclerotization. Moreover, the presence of two ovaries large enveloping bursa and conspicuous head sclerotization of the genera Tylenchorhynchus and Telotylenchus show affinities with the members of Heteroplaimidae indicating the gradual line of development of cephalic framework from the genera like Psilenchus ahd Basiria to Tylenchorhynchus and Telotylenchus via Ditylenchus and Pseudhalenchus leading to the families Pratylenchidae and Heteroplaimidae.

Siddiqi (1963) has rightly pointed out that the genera "Psilenchus, Basiria and Macrotrophurus together form a group within Tylenchidae characterized by having broad slit-like amphidial apertures which are located behind the base of lateral lips; distinct deirids and phasmids; elevated dome-shaped head

and the corpus of the oesophagus (Procorpus with median oesophageal bulb) measuring more than half the total oesophageal length". This will certainly deserve a sub-family rank, if not the family rank, when in future some more related genera and species are added to it.

Siddiqi (1960) described the genus Telotylenchus, which he placed along with Pseudhalenchus Tarjan, 1958 in a new sub-family Telotylenchinae. Loof (1963) has rightly questioned the creation of this sub-family. The two genera in question exhibit resemblance only with respect to the form of basal oesophageal region, a character not enough to warrant the creation of a separate subfamily. On the other hand Telotylenchus Siddiqi, 1960 resembles more with Tylenchorhynchus Cobb, 1913 with regard to the shape of head and spear, relative dimension of the various body parts, number and form of Ovaries, shape of the tail in both sexes, details of male reproductive organs and the large size of phasmids. Whenever, in future a higher rank is given to the genera of Tylenchidae (Filipjev, 1934) Thorne, 1949, Telotylenchus and Tylenchorhynchus will be placed together. Similarly Pseudhalenchus and Ditylenchus Filipjev, 1936 will be placed together in view of their similarity with each other.

The superfamily Aphelenchoidea is represented by four families. The families Aphelenchidae (Fuch, 1937) Steiner, 1949; Anonchytidae

Goodey, 1960 and Paraphelenchidae (T. Goodey, 1951) J.B. Goodey, 1960 with Aphelenchus Bastian, 1865, Anonyctus Allen, 1940 and Paraphelenchus (Micoletzky, 1922) Micoletzky, 1925 as their respective representatives, whereas the family Aphelenchoididae (Skarbilovich, 1947) Paramonov, 1953 is represented by fifteen genera of varied types of parasitism among which are obligate plant parasites, mycophages, predators, insect parasites and associates.

The genera Seinura Fuchs, 1931 and Paraseinura Timm, 1961 form a separate group in the family Aphelenchoididae characterized by long, attenuated to filiform tails without a terminal mucro; differently shaped spicules and in the presence of short gubernaculum in Paraseinura which is absent in other members. Further the genus Rhadinaphelenchus Goodey, 1960 possesse remarkably distinct and outstanding diagnostic characters e.g. very slender body, massive sclerotization of the labial arches, elongated median bulb, wide vulvar-flap, unusually curved vagina, shape of the spicules and sclerotized spade-like extension of the male tail. In view of these characters it deserves a higher rank, but for the present it is preferred not to go further than indicating groups of genera standing closer to each other rather than actually forming subfamilies or families.

Order Tylenchida (Filipjev, 1934) Thorne, 1949.

Syn. Heteroderata (Filipjev, 1934) Skarbilovich, 1959.

Nematodes: Cuticle annulated. Amphids small and pocket-like. Phasmids present. Caudal glands absent. Stoma with a protrusible, hollow spear formed by fusion of some of the rhabdions. Excretory system with a single lateral canal. Oesophagus consisting of procorpus, corpus or median bulb with crescentic valve plates (median bulb without valvular apparatus in Neotylenchidae), isthmus and terminal glands or basal bulb.

Type superfamily: Tylenchoidea (Filipjev, 1934) Chitwood and Chitwood, 1937.

Key to the superfamilies of Tylenchida.

1- Orifice of the dorsal oesophageal gland in procorpus—Tylenchoidea.

Orifice of the dorsal oesophageal gland in median bulb—Aphelenchoidea.

Superfamily Tylenchoidea (Filipjev, 1934) Chitwood and Chitwood, 1937.

Diagnosis: Tylenchida: Dorsal oesophageal gland emptying into a lumen of oesophagus between the spear base and medi bulb or in that position even if median bulb is absent.

Key to the families of Tylenchoidea.

1- The adult male and female parasitic in galls of flower buds. Leaf buds and stem tips while the fertilized females parasitic in the haemocoel of female larvae of an insect.....Fergusobidae Siddiqi & Goodey,
Plant parasitic only, no double parasitism.....2

2- Median oesophageal bulb provided with valvular apparatus.....3
Median oesophageal bulb not provided with valvular apparatus .....Neotylenchidae (Thorne,1941) Thorne,1949.

3- Median oesophageal bulb greatly enlarged; isthmus and basal bulb reduced; cuticle distinctly annulated, sometimes ornamented.....Criconematidae (Taylor,1936) Thorne,1949.
Median oesophageal bulb small to moderate; cuticle finely or coarsely annulated, never with spines.....4

4- Female sessile, obligate parasites, saccate, pyriform or lemon-shaped, sometimes cyst forming; male tails short, rounded, without bursae------Heteroderidae (Filipjev,1934) Skarbilovich,1947.
Females free-living ecto-parasites or migratory ecto-parasites on roots except Rotylenchulus and Nacobbus.....5

5- Cephalic framework heavily sclerotized.....6

Cephalic framework not heavily sclerotized.....7

6- Head conoid, mostly setoff, elevated; female tail usually less than anal-body diameter in length; phasmids small or large scutellum.....

.....Hoplolaimidae (Filipjev,1934) Wieser,1953.

Head flat, not markedly elevated from body; female tail more than anal-body diameter in length; phasmids small, pore-like.....Pratylenchidae (Thorne,1949) Siddiqi,196

7- Females vermiform----------Tylenchidae Filipjev, 1934.

Females swollen, saccate....Tylenchulidae(Skarbilovich,194

Kiryanova, 1955.

Family Tylenchidae Filipjev, 1934.

Majority of the species belonging to the family Tylenchidae are found around the roots of plants. A few species of Tylemchorhynchus Cobb, 1913 have been reported as migratory endoparasites. T. Goodey (1932) found T. macrurus (T.Goodey,1932) Filipjev, 1936 with the anterior third of the body within the cortex of roots of oats and Lolium perenne L., the remainder of the body lying outside the roots. T. claytoni Steiner, 1937 was found attacking tobacco and its pathogenicity was established by Graham (1954). Mountain (1954) reported it on wheat and oats. Das (1960) reported T. digitatus Das, 1960 and T.dactylurus Das, 1960 ~~and~~ from the roots of Ricinus Communis L. and Capsicum annuum L. respectively from Hyderabad, South India. Siddiqi (1961) reported T. indicus Siddiqi, 1961 from the roots of Saccharum officinarum L. and Cajanus indicus L. Recently the author has found T.brevidens Allen, 1955 severely infecting the cabbage plants at Aligarh, U.P., India.

The genera Anguina Scopoli, 1777 and Paranguina Kiryanova, 1955 have been found producing galls on flowers, stems, leaves and rhizomes of various plants, specially cereals and grasses. "Ear-Cockle" disease of wheat caused by Anguina tritici (Steinbuch, 1799) Filipjev, 1936 is quite common in Western U.P. (Saxena and Khan, 1964).

Although Ditylenchus dipsaci (Kuhn, 1857) Filipjev, 1936, Ditylenchus radicicolus (Greef, 1872) Filipjev, 1936 and D.destructor Thorne, 1945 are quite destructive but only the last named species has so far been reported from India.

Key to the genera of Tylenchidae Filipjev, 1934.

1- Spear base furcate, appearing like and invested by----------
---------Chitinotylenchus (Micoletzky, 1922) Filipjev,1936.
Spear base not furcate----------2

2- Amphids located well behind the lateral lips----------3
Amphids located in the lips----------5

3- Spear very long; tail of female short, broadly rounded------
----------Macrotrophurus Loof, 1958.
Spear short, tails of both sexes long and filiform----------4

4- Spear without knobs; tails often clavate----------
----------Psilenchus De Man, 1921.
Spear with three well developed basal knobs; tails not clavate but with rounded terminus---Basiria Siddiqi, 1959.

5- Ovary single----------8
Ovary paired----------6

6- Basal oesophagus bulbar, well set off from the intestine----
----------7
Basal oesophagus glandular, overlapping the intestine-------
----------Telotylenchus Siddiqi, 1961.

7- Cephalic framework conspicuously sclerotized; tail terminus broadly rounded; Bursa enveloping the male tail----------
----------Tylenchorhynchus, Cobb,
Cephalic framework weak, tail terminus subacutely rounded; Bursa sub-terminal----------Tetylenchus Filipjev, 1936.

8- Vulva at mid-body; tail hemispherical; bursa caudal--------
----------Trophurus Loof, 1956.
Vulva in posterior third of body; tail elongate-conoid to filiform; bursa caudal, sub-caudal or adanal----------9

9- Female body obese producing galls on host; gonad cells arranged about a rachis----------10
Females slender, active, not producing galls on host; gonad cells not arranged about a rachis----------11

10- Basal bulb lobed; cardia bearing sculptures and patterns-----
----------Paranguina Kiryanova, 1955.
Basal bulb pyriform; cardia not bearing sculptures and patterns----------Anguina Scopoli, 1777.

11- Tails elongate, filiform, bursa short or absent----------12
Tails conoid, never filiform, bursa sub-caudal or caudal----15

12- Head bearing setae----------14
Head not bearing setae----------13

13- Lip-region striated, without a lip cap; spear short----------
----------Tylenchus Bastian, 1865
Lip-region unstriated, lip-cap present; spear very long-------
---------- ----------Tylodorus Meagher, 1963.

14- Bursa absent----------Atylenchus Cobb,1913.

Bursa present----------Eutylenchus Cobb,1913.

15- Basal oesophagus forming long lobe overlapping intestine---

----------Pseudhalenchus Tarjan, 1958.

Basal oesophagus bulbar, sometimes slightly overlapping

intestine----------16.

16- Bursa terminal----------17.

Bursa sub-terminal----------Ditylenchus Filipjev,193

17- Excretory pore at the level of or anterior to the median

bulb; lateral lips of the head narrower and protude more

anteriorly and laterally than the others----------

----------Sychnotylenchus Ruhm,1956.

Excretory pore always behind the level of median bulb; lateral lips of the head equal----Neoditylenchus Meyl,1960.

The Genus Tylenchus Bastian, 1865.

Diagnosis: Tylenchidae: Lip-region striated. Vulva posterior. Gonad prodelphic, outstretched. Short post-uterine sac present. Bursa adanal or absent. Tails long and filiform. Deirids usually prominent at level of excretory pore. Cuticle finely or coarsely annulated. Lateral fields with incisures. Head skeleton apparently absent. Spear strongly or weakly developed, with or without basal knobs, Isthmus long and slender ending in a rather

pyriform basal bulb. Oesophago-intestinal valve cells present.

The genus Tylenchus comprises six sub-genera, five proposed by Andrassy (1954,59) and one by Goodey (1962). The author has proposed one more new sub-genus.

A key to the sub-genera of Tylenchus Bastian, 1865.

1- Cuticle distintly to strongly annulated; spear well developed and knobbed----------2

Cuticle delicately to finely annulated; spear weak with or without knobs----------6

2- Lateral field marked by two incisures only----------3

Lateral field marked by more than two incisures----------4

3- Males without bursa----------Miculenchus Andrassy, 1959.

Males with moderately developed bursa----------Ottolenchus n.subgen.

4- Lateral field with six incisures; Head set off----------Cephalenchus Goodey, 1962

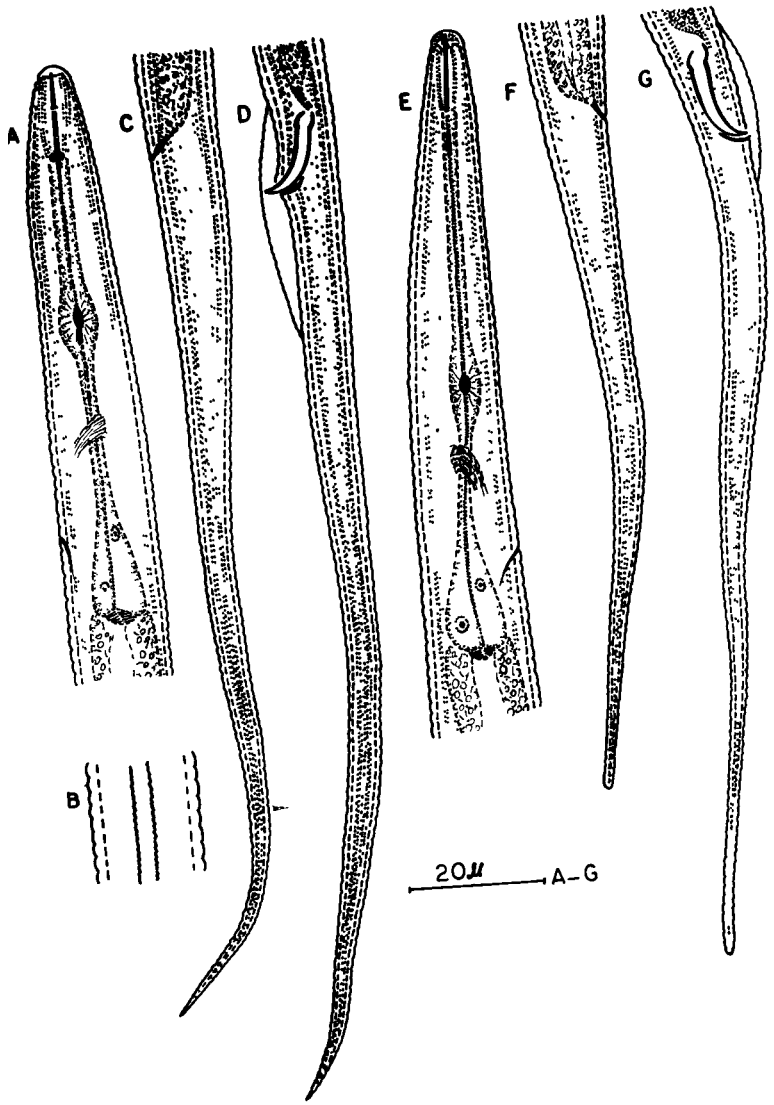
Lateral field with less than six incisures----------5

5- Tail relatively short with a ventral curvature and tip recurved----------Tylenchus Filipjev,1934.

Tail long and slender; Vulva with lateral flap of cuticle----Aglenchus Andrassy,1954.

6- Medium to large sized nematodes; bursa moderately developed----------Filenchus Andrassy,1954.

Small sized nematodes; bursa weak, almost rudimentary; gubernaculum often degenerate---Lelenchus Andrassy,1954


A
B
C
D
E
F
G
20μ
A-G

Tylenchus subgenus Ottolenchus n.subgen.

Diagnosis: Tylenchus: Small sized nematodes. Body cuticle strongly annulated. Lateral field with only two, strongly crenate, incisures running parallel to the body till anus or cloaca. Head rounded with a slight depression at the base of lip-region, without clear annulations. Median bulb well

um

h is

Type Species: Tylenchus (Ottolenchus) equisetus n.subgen.n.sp.

(Plate No.1; Fig. A-D.)

MEASUREMENTS OF TWELVE FEMALES:-

L = 0.38-0.47 mm; a = 27.1-28.4; b = 5.4-6.5; c = 4.4-4.6;

V = 58.4-61.8%; Spear = 12-14 µ.

MEASUREMENTS OF EIGHT MALES:

L = 0.40-0.48 mm; a = 29.8-34.6; b = 5.3-6.3; c = 3.5-4.7;

Spear = 12-14 µ; Spicules = 15-17 µ; Gubernaculum = 5-6 µ.

DESCRIPTION:

Body cylindrical, open C-shaped when relaxed by gentle heat, tapering at both extremities. Cuticle and sub-cuticle strongly annulated. Head flat and rounded with a slight depression at the base of the lip-region. Spear with rounded basal knobs, 12-14 µ in length. Orifice of the dorsal oesophageal gland close to

spear base. Procorpus a slender tube ending in an oval valvulated median bulb. Isthmus long and slender, encircled by a nerve ring. Excretory pore situated at 68-72 μ from the anterior end of the body. Basal oesophageal bulb spindle-shaped with three gland nuclei, setoff from the intestine. Cardia rounded. The distance *from the anterior end of the body to the centre of the median* bulb is slightly longer than the distance from the latter to the base of oesophagus.

Vulva with reduced lateral cuticular flap, post-equatorial in position. Ovary single, prodelphic, outstretched with oocytes arranged in a single file. Oval spermatheca present. Post-uterine sac short, half the vulvar-body width long. Tail long and filiform with acute terminus, 12-14 times the anal-body width long, tip often recurved. Lateral field marked by two strongly crenate incisures, running parallel to the body upto the anus or cloaca.

Males similar to females in shape and appearance. Body more slender than females. Testis single, outstretched. Spicules paired tylenchoid, ventrally curved and cephalated, 15-17 μ in length. Gubernaculum simple, 5-6 μ long. Bursa moderately developed, distinctly crenate, originating at the level of the head of the spicules and terminating at more than two cloacal-body diameter behind the cloaca, nearly four times the cloacal-body width long. Tail 14-16 times the cloacal-body width long with acutely pointed terminus. Phasmids post-anal, nearly one cloacal-body width

behind the cloaca.

HOLOTYPE: Female, slide No.101, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of Casuarina equisetifolia Forst.

TYPE LOCALITY: University Campus, A.M.U., Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Tylenchus subgen. Ottolenchus n. subgen. comes closer to T.subgen. Miculenchus Andrassy, 1959 and T.subgen. Aglenchus Andrassy, 1954. It differs from the former in possessing moderately developed bursa in males (Bursa absent in Miculenchus) and lip-region not clearly annulated while from the latter it differs in possessing oval median bulb (median bulb round in Aglenchus) and only two strongly crenate incisures in the lateral field.

Tylenchus subgen. Lelenchus Andrassy, 1954.

Syn. Lelenchus (Andrassy,1954) Meyl,1960.

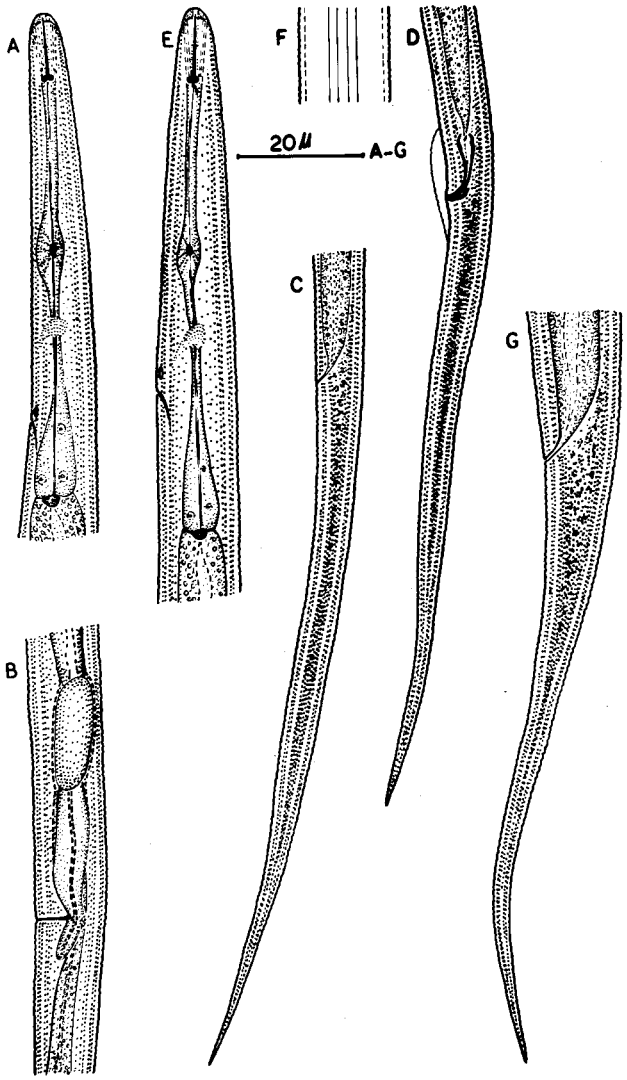
DIAGNOSIS: Tylenchus: Body small (0.30-0.70 mm). Head hardly offset. Cuticle very finely annulated. Spear weak and often hardly knobbed. Median bulb oval. Bursa weak, almost rudimentar Gubernaculum often degenerate. Tail long and slender.

Type Species: Tylenchus (Lelenchus) Leptosoma de Man, 1880 (Andrassy, 1954).

Plate No.2.

Fig. A-E. Tylenchus (Lelenchus) majus n.sp. A- Oesophageal region of female; B- Portion of female reproductive region; C- Female tail; D- Male tail.

Fig. E-G. Tylenchus (Lelenchus) cynodontus n.sp. E- Oesophageal region of female; F- Lateral field; G- Female tail.


A
E
F
D
20μ
A-G
C
G
B

Tylenchus (Lelenchus) cynodontus n.sp.

(Plate No.2; Fig. E-G.)

MESUREMENTS OF SIX FEMALES: L = 0.395-0.485 mm; a = 26.2-32.0; b = 4.7-5.2; c = 4.3-5.2; V = 60.0-64.5%; Spear = 9-11 µ.

DESCRIPTION: Body cylindrical, ventrally arcuate when relaxed by gentle heat, tapering on both extremities. Cuticle finely annulated. Lateral field marked by four incisures, outer ones being crenate, occupying nearly 1/3 the corresponding body width. Lip region continuous with the body contour, flat and rounded, narrower than front end of body. Spear short with small rounded basal knobs, 9-11 µ long. Orifice of the dorsal oesophageal gland close to spear base. Procorpus a slender tube ending in a fusiform swelling representing the valvulated median bulb. Isthmus long encircled by a nerve ring. Hemizonid distinct, situated 2-3 body annules anterior to the excretory pore. Basal oesophageal bulb elongate-pyriform. Cardia rounded. The distance from the anterior end of the body to the centre of the median bulb is equal to the distance from the latter to the base of oesophagus. Rectum short, nearly 1/3 of the anal-body width long. Tail long and filiform, with acute terminus, measuring nearly eight times the anal-body width. Last 1/4 of the tail dorsally bent.

Vulva post-equatorial. Ovary single, prodelphic, outstretched with oocytes arranged in a single file. Elongate pouch-like

spermatheca present, measuring 20 X 7 µ. Post-uterine sac short, nearly half the vulvar-body width long.

HOLOTYPE: Female, slide No.102, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of Cynodon dactylon (L.) pers.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Tylenchus (Lelenchus) cynodontus n.sp. comes closer to T.(L.) discrepans Andrassy, 1954 but differs from it in the absence of males, size of the spear (Spear = 7.0-7.7 µ in T.(L.) discrepans), length of the tail. (C = 4.0-4.4 in T.(L.) discrepans) continuous head and comparatively more posteriorly located vulva.

Tylenchus (Lelenchus) majus n.sp.

(Plate No. 2; Fig. A-D.)

MEASUREMENTS OF FOUR FEMALES:-

L = 0.36-0.42 mm; a = 32.3-34.5; b = 5.4-6.9; c = 3.7-4.8; V = 62.5-63.8%; Spear = 10-11 µ.

MEASUREMENTS OF THREE MALES:-

L = 0.35-0.38 mm; a = 31.8-38.9; b = 4.6-5.0; c = 3.5-4.1; Spear = 10-12 µ; Spicules = 11-12 µ; Gubernaculum = 3 µ.

DESCRIPTION: Body cylindrical, ventrally arcuate when relaxed by gentle heat, tapering on both extremities. Cuticle finely annulated. Lateral field marked by four incisures. Lip region rounded, continuous with the body contour, annulated, annulations faint. Spear short with rounded basal knobs, 10-11 μ long. Orifice of the dorsal oesophageal gland close to spear base. Corpus a slender tube ending in a fusiform valvulated median bulb. Isthmus slender, encircled by a nerve ring near its middle. Basal oesophageal bulb spindle-shaped. Cardia round. Excretory pore 58-63 μ apart from the anterior end of the body. Hemizonid distinct, situated just anterior to the excretory pore. Distance from the anterior end of the body to the centre of the median bulb is equal to the distance from the latter to the base of the oesophagus. Intestinal region granular. Rectum very short. Tail long and filiform with acutely pointed terminus, nearly fifteen times the anal-body width long. Phasmids could not be seen.

Vulva post-equatorial. Ovary single, prodelphic, outstretched with oocytes arranged in a single file. Elongate, pouch-like spermatheca present. Post-uterine sac short, nearly half the vulvar-body width long.

Males similar to females in shape and appearance. Testis single, outstretched. Spicules paired, arcuate, 11-12 μ long. Gubernaculum short and simple, 3 μ in length. Bursa rudimentary,

slightly less than two cloacal-body width long. Tail as in females.

HOLOTYPE: Female, slide No. 103, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of Hibiscus rosa-sinensis L.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: Tylenchus (Lelenchus) majus n.sp. comes closer to T.(L.) discrepans Andrassy, 1954 and T.(L.) infirmus Andrassy, 1954. It differs from the former in the position of vulva, size of the spear and the length of the tail (tail 10 times the anal-body width long in T.(L.) discrepans and from the latter in the larger size of the body and position of vulva (V=57.9% in T.(L.) infirmus).

A Key to the species of the subgenus Tylenchus (Lelenchus).

1- Body size 0.71 mm. ----------micoletzkyi Andrassy, 1954.

Body size less than 0.66 mm.----------

2. Body size of females less than 0.30 mm----------

----------infirmus Andrassy,1954.

Body size of females 0.34 mm or more.----------

3. Bursa and gubernaculum undeveloped; spicules short, 7-8 µ long--

----------aberrans Altherr, 1952 (Andrassy,1954)

Bursa and gubernaculum moderate or normal; spicules more than 8 μ long----------4

4- V = 47-60%; a = 40-60; c = 2.7-4.0.----------
----------Leptosoma de Man,1880 (Andrassy,1954).

V = 60% or more; a = 27-35; c = 3.7-6.5.----------5

5- V = 64.6-66.8%; tail ventrally curved, ten times the anal-body width long-----minutus Cobb, 1893(Andrassy,1954)

V = less than 64.5%----------6

6- Males known----------7

Males not known----------cynodontus n.sp.

7- V = 61.2-61-4%; tail ten times the anal-body width long; head offset----------discrepans Andrassy, 1954.

V = 62.5-63.8%; tail fifteen times the anal-body width long; head continuous with body contour----------
----------majus n.sp.

Genus Psilenchus De Man, 1921.

DIAGNOSIS:Tylenchidae: Cuticle and sub-cuticle well striated. Head skeleton absent. Amphids conspicuously wide transverse slits, placed laterally behind the lateral lips. Spear without basal knobs Orifice of the dorsal oesophageal gland close to or considerably behind the base of the spear. Deirids and phasmids prominent. Lateral field marked by incisures or plain. Tails of both sexes long and filiform, terminally clavate. Length of procorpus greater than the length of isthmus and terminal bulb. Terminal

bulb pyriform, well setoff from the intestine. Cardia prominent. Ovary single or paired, outstretched. Bursa adanal.

Type Species; Psilenchus hilarulus De Man, 1921.

Psilenchus raski* n.sp.

(Plate No.I; Fig.E-G)

MEASUREMENTS OF EIGHT FEMALES: L = 0.58-0.62 mm; a = 31-33; b = 6.1-6.7; c = 5.5-6.1; V = 63-67%; Spear = 12 µ.

MEASUREMENTS OF ONE MALE: L = 0.58mm; a = 39; b = 7.3; c = 5.7; Spear = 12 µ; spicules = 17 µ; Gubernaculum = 4 µ.

DESCRIPTION: Small nematodes, ventrally arcuate on death with the tail end bent dorsally; tapering on both extremities. Cuticle finely annulated. Lateral field marked by six incisures, outer ones being crenate. Amphids as transverse slits, located well behind the lateral lips. Lip region not striated, continuous with the body contour. Spear slender, without basal knobs. Orifice of the dorsal oesophageal gland 6 µ behind the spear base. Procorpus an elongate cylindrical tube ending in a fusiform valvulat median bulb. Basal oesophageal bulb spindle-shaped. Cardia conoid and short. Nerve ring crosses the isthmus near its middle. Excretory pore situated at 73-78 µ from the anterior end of the body. The distance from the head end to the median bulb is greater

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* Named after Dr. D.J. Raski, Nematologist, University of California, Davis California, U.S.A.

than the distance from the latter to the base of oesophagus.

Vulva a transverse slit. Vagina about half the corresponding diameter of the body. Ovary single, Prodelphic, outstretched with oocytes arranged in a single file except for a short region of multiplication. Post-uterine sac less than the vulvar-body diameter in length. Rectum shorter than the anal-body width. Tail long and filiform with clavate terminus, about ten times the anal-body width long.

Male similar to females in general appearance. Testis single, outstretched. Spicules paired, similar, cephalated, ventrally arcuate, 17 μ in length. Gubernaculum simple, 4 μ long. Bursa crenate, adanal. Phasmids at the level of anal opening.

HOLOTYPE: Female, Slide No. 121, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of *Rosa* sp.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: *Psilenchus raski* n.sp. comes close to *P.magnidens* Thorne, 1949 and *Psilenchus noctiscriptus* Andrassy, 1962. It differs from the former in the body size, presence of males, shape of the tail, tip, number of incisures in the lateral field and the distance from the anterior end of the body to the

median bulb and from the latter in the size of post-uterine sac and the number of incisures in the lateral field.

KEY TO THE SPECIES OF PSILENCHUS
(Modified after Siddiqi,1963)

1- Ovaries paired----------2
Ovary single----------8

2- Gland opening close to spear base----------5
Gland opening at ½-1/3 spear length behind the base of the spear----------3

3- Lip region striated; phasmids at less than anal-body width posterior to anus----------Hilarus Siddiqi, 1963
Lip region not striated; phasmids at about two or more anal-body width posterior to anus----------4

4- V = 47.6%; c = 5.8; L = 0.85 mm ------Minor Siddiqi, 1963
V = 49-52%; c = 8-9; L = 0.71-1.12 mm----------
----------neoformis Jairajpuri,1963

5- Tail end clavate----------6
Tail end pointed----------terextremus Hegemeyer & Aller 1952.

6- Lip region smooth, spear aperture fine----------7
Lip region striated, spear aperture wide----------
----------striatus Thorne, 1949.

7- Tail much attenuated, over ten times anal-body widh long---
----------hilarulus De Man,
Tail not much attenuated, 6.2-8-3 times the anal-body width long----------aestuarius Andrassy,1962.

8- Tail terminus finely pointed; post uterine sac ½ vulvar-body width long----------magnidens Thorne,1949.

Tail terminus rounded or clavate----------9

9- Post-uterine sac less than one vulvar-body width long----------raskii n.sp.

Post-uterine sac one vulvar-body width long----------noctiscriptus Andrassy, 1962.

It is felt that the status of Psilenchus clavicaudatus (Micoletzky, 1922) Thorne, 1949; P.tumidus Colbran, 1960 and P.duplexus Hagemeyer and Allen, 1952 is doubtful and therefore they have not been included in the key.

The genus Ditylenchus Filipjev, 1936 (nomen nudum,1934)

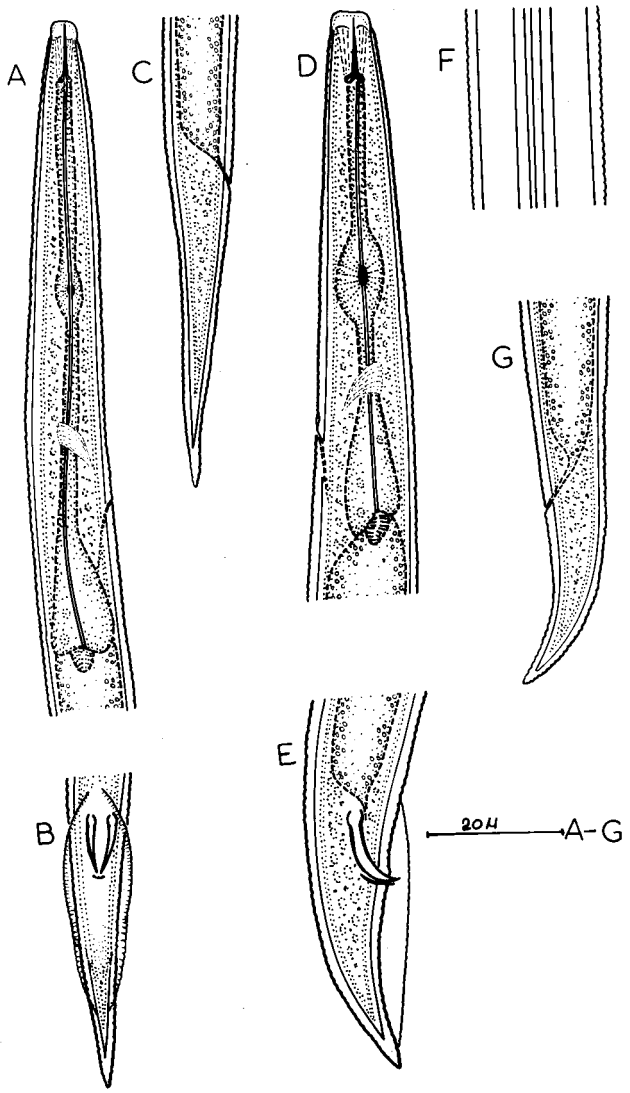
Diagnosis: Tylenchidae: Lip region smooth or striated. Lateral fields with four or more incisures. Deirids small. Phasmids obscure. Posterior portion of oesophagus a clavate or variously expanded bulb, sometimes lobed behind and extending slightly over the intestine. Ovary single, prodelphic and outstretched. Short post-uterine sac present. Cells of gonads in one or two lines, not arranged about a rachis. Tails of both sexes conoid, tapering to acute or sub-acute terminus. Bursa sub-caudal.

Type Species: Ditylenchus dipsaci (Kuhn, 1857) Filipjev,1936.

Plate No. 3.

Fig. A-E,F. Ditylenchus minutus n.sp. A- Oesophageal region of female; B- Male tail (ventral view); C- Female tail; E- Male tail (lateral view).

Fig. D,F,G. Ditylenchus cyperi n.sp. D- Oesophageal region of female; F- Lateral field; G- Female tail.


A
C
D
F
G
B
E
20μ
A-G

Ditylenchus minutus n.sp.

(Plate No.3 ; Fig.A-C,E.)

MEASUREMENTS OF FIFTEEN FEMALES:

L = 0.35-0.48 mm; a = 20.0-26.5; b = 4.5-4.7; c = 10.0-12.5; V = 72.2-79.5%; Spear = 8-9 µ.

MEASUREMENTS OF FIVE MALES:

L = 0.32-0.38 mm; a = 22.8-25.3; b = 4.2-4.7; c = 9.0-10.0; Spear = 8-9 µ; Spicules = 14-15 µ; Gubernaculum = 4-5 µ.

DESCRIPTION:

Body cylindrical, regularly tapering towards both extremities. Cuticle finely annulated. Lateral field marked by four incisures. Lip region slightly setoff, striated. Buccal spear weak, with small, rounded basal knobs. Orifice of the dorsal oesophageal gland close to the spear base. Procorpus a slender tube ending in an oval valvulated median bulb. Isthmus long, encircled by a nerve ring posterior to its middle. Basal oesophageal bulb distinctly setoff from the intestine. Cardia obscure. Excretory pore 64 u apart from the anterior end of the body. Hemizonid three body annules long, located just anterior to the excretory pore.

Vulva a transverse slit. Ovary single, prodelphic, outstretch with oocytes arranged in a single file. Post-uterine sac twice or more than twice the vulvar-body width long, extending half

way to anus from the vulva. Rectum half or less than half the anal-body width long. Tail elongate-conoid with sub-acute terminus.

Males similar in appearance to females. Testis single, outstretched, spermatocytes serially arranged. Spicules paired, ventrally arcuate, cephalated, 14-15 μ long. Gubernaculum simple, trough-shaped, 4-5 μ in length. Bursa crenate, enveloping less than 1/4 of the tail length. Tail ventrally arcuate, regularly tapering and ending in a sub-acute terminus.

HOLOTYPE: Female, collected in October, 1964, slide No. 115, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the female; other data same as for holotype.

TYPE HABITAT: Soil around the roots of ~~Pome granate~~ Punica granatum L.

TYPE LOCALITY: Ghazipur, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Ditylenchus minutus n.sp. comes closer to D.misellus Andrassy, 1958, as regards body size but can atonce be differentiated by the almost straight body shape on being relaxed (spiral in D.misellus); more posteriorly located vulva (V = 68.2% in D.misellus); more robust body and short tail.

Ditylenchus cyperi n.sp.

(Plate No. 8 ;Fig. D,F.G)

MEASUREMENTS OF TEN FEMALES:

L = 0.50-0.66 mm; a = 18.3-29.4; b = 5.2-6.3; c = 17.2-17.8; V = 74.7-83.6%; Spear = 10-11 μ.

MEASUREMENTS OF TWO MALES:

L = 0.46-0.50 mm; a = 21.7-32.8; b = 4.5-4.8; c = 15.6-17.0; Spear = 10-11 µ; Spicules = 17-18 µ; Gubernaculum = 8-9 µ.

DESCRIPTION: Body cylindrical, tapering on both extremities, slightly arcuate on death. Cuticle finely annulated. Lateral field marked by five incisures. Lip region continuous with the body contour, flat and rounded. Spear weakly developed with knobs, 10-11 µ long. Orifice of the dorsal oesophageal gland close to spear base. Corpus a slender tube with oval valvulated median bulb. Basal oesophageal bulb slightly overlapping the intestine ventrally. Isthmus encircled by a nerve ring. Excretory pore situated near the begining of the basal oesophageal bulb. Hemizonid 3-4 body annules long, situated just anterior to the excretory pore.

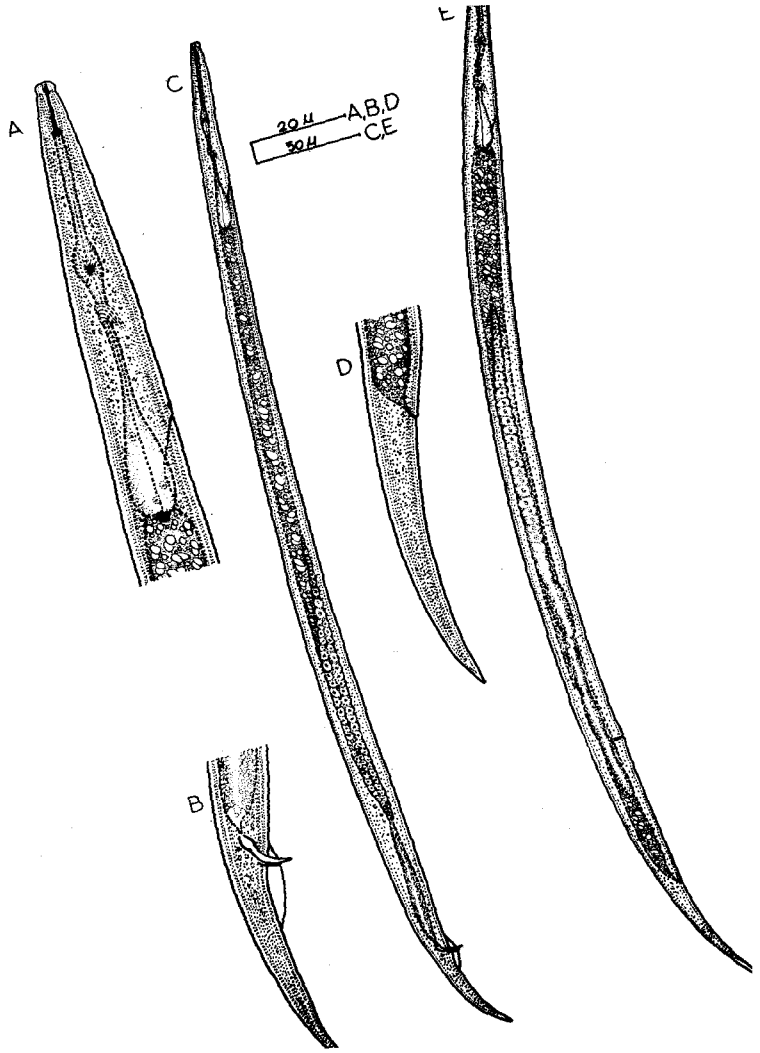
Vulva a transverse slit. Ovary single, prodelphic, outstretch with oocytes arranged in a single file. Rounded spermatheca present. Post-uterine sac extending half way to the vulva-anus distance. Tail convex-conoid ending in a sub-acute terminus.

Males similar to females in general appearance. Testis singl outstretched. Spermatocytes serially arranged. Spicules paired, ventrally arcuate, cephalated, 17-18 µ long. Gubernaculum simple 8-9 µ in length. Bursa sub-caudal, originating at the level slightly anterior to the head of the spicules.

HOLOTYPE: Female, collected in December, 1964, slide No. 116 deposited with the Plant Pathology Section, Department of Botany Aligarh Muslim University, Aligarh, U.P., India.

Plate No.4.

Fig. A-E. *Ditylenchus ausafi* n.sp. A- Head end of female; B- Male tail; C- Male; D- Female tail; E- Female.


A
B
C
D
E
20 µ
30 µ
A,B,D
C,E

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Cyperus rotundus L.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: Ditylenchus cyperi n.sp. comes closer to D.nannus Siddiqi, 1963, D.mirus Siddiqi, 1963; D.procerus (Bally and Raydon, 1931) Filipjev, 1936 and D.dipsecoidens (Andrassy, 1952) Andrassy, 1956 but differs from, (i) D.nannus in the position of vulva, size of the spear and spicules and in the tail shape; (ii) D.mirus in the position of vulva, size of the spear and gubernaculum and in tail shape; (iii) D.procerus in the body width and tail length (c = 14 in D.procerus) and (iv) D. dipsecoidens in the longer post-uterine sac, lateral field with five incisures and more terminal bursa in males.

Ditylenchus ausafi* n.sp.

(Plate No. 4 ; Fig.A-E.)

MEASUREMENTS OF EIGHT FEMALES: L = 0.51-0.61 mm; a = 24.3-29.0; b = 5.7-6.6; c = 9.0-10.2; V = 71.8-75.4%; Spear = 10-11µ.

MEASUREMENTS OF TWO MALES: L = 0.45-0.47 mm; a = 32-34; b = 4.9-5.2; c = 9.0-9.5; Spear = 10-11 µ; Spicules = 14-15 µ; Gubernaculum = 7-8 µ.

DESCRIPTION: Body cylindrical, tapering on both extremities, slightly arcuate on death. Cuticle finely annulated. Lateral

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* Named after S. Ausaf Husain, my elder brother who helped me in collecting soil samples infested with this nematode species.

field marked by four incisures. Lip region setoff from the body contour, annulated. Spear weak, 10-11 μ long. Orifice of the dorsal oesophageal gland close to spear base. Corpus a slender tube ending in an oval valvulated median bulb. Isthmus long, encircled by a nerve ring. Basal oesophageal bulb pyriform in shape. Excretory pore 76-82 μ apart from the anterior end of the body. Hemizonid prominent, 3-4 body annules long, located just anterior to the excretory pore.

Ovary single, prodelphic, outstretched with oocytes arranged in a single file, sometimes reaching near the basal oesophageal bulb. Prominent spermatheca with sperms present. Post-uterine sac slightly more than vulvar-body width long. Tail long elongate-conoid with sub-acute terminus.

Males similar in appearance to females. Testis single, outstretched. Spermatocytes serially arranged. Spicules paired, ventrally arcuate, cephalated, 14-15 μ long. Gubernaculum simple, 7-8 μ in length. Bursa enveloping 1/3 of the tail length. Tail shape as in females.

HOLOTYPE: Female, collected in December, 1964, slide No.117, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of Rosa sp.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: D.ausafi n.sp. comes closer to D.cyperi n.sp., D.nannus Siddiqi, 1963, D.mirus Siddiqi, 1963 and D.dipsecoideus (Andrassy, 1952) Andrassy, 1956 but differs from (i) D.cyperi in the number of incisures in the lateral field, long tail, short bursa and anteriorly located vulva; (ii) D.nannus and D.mirus in possessing long tail, short bursa, shape of the tail terminus and more anteriorly located vulva and (iii) D.dipsecoideus in short bursa and longer body.

KEY TO THE SPECIES OF DITYLENCHUS

1- Body coiled or spiral----------2
Body slightly arcuate or nearly straight----------4

2- Length of body 0.80-1.2 mm; V = 73-83% ----------3
Length of body 0.328 mm; V = 68.2%----------
----------misellus Andrassy, 1958.

3- a = 28-31; b = 8.0-11.5; V = 73-78%----------
----------askenasyi (Butschli,1873)Goodey,1951.
a = 15-19; b= 5-7; ~~c~~ V = 78-83% ----------
----------brenani (Goodey,1945) Goodey,1951.

4- Body obese----------5
Body slender, not obese----------6

5- Causing galls on above ground parts of plants ----------
----------graminophillus (Goodey 1933) Filipjev,1936.
Causing galls on underground parts of plants----------
---------- radicicolus (Greef,1872) Filipjev, 1936.

6- Tail end sickle-shaped--------drepanocercus Goodey, 1953.
Tail end not sickle-shaped----------7

7- Four or five incisures in the lateral field----------8

Six incisures in the lateral field----------9

8- Five incisures in the lateral field----------cyperi n.sp.

Four incisures in the lateral field----------1

9- Post-uterine sac 2½-3 times the vulvar-body width long--------1

Post-uterine sac less than 2½ times the vulvar-body width long-

10- Tail terminus pointed; V =74-79%; c = 12-15----------

----------convallariae Sturhan and Friedman,1965.

Tail tip not pointed; V =78-83%; c=15-20----------

----------destructor Thorne, 1945.

11- Post-uterine sac extending half way the vulva-anus distance---

----------myceliophagus Goodey, 1958.

- Post-uterine sac extending 1/4 to 1/3 of vulva-anus ----------

distance----------triformis Hirschmann & Sasser, 1955.

12- Body slender, a=50-60---intermedius(De Man,1880)Filipjev,1936.

less

Body/slender; a = 36-45----------

13- Average body length more than 0.65 mm----------

---------procerus (Bally & Raydon,1931) Filipjev,1936.

Average body length less than 0.60 mm ----------

14- c = 9.0-16.0----------

c = 17-20 ----------

15- c=9.0-12.5----------16

c=12-16------dipsecoideus (Andrassy,1952) Andrassy,1956.

16- Serious plant parasites----------19

Not serious pests as far as known----------18

17- Bursa envelopping less than 1/3 of the tail length;
L=0.51-0.61 mm;----------ausafi n.sp.

Bursa enveloping more than half of the tail length;
L=0.35-0.48 mm----------minutus n.sp.

18- Tail tapering regularly upto its middle, then narrowed sharply to a ventrally arcuate terminal portion; tail tip smoothly rounded----------nannus Siddiqi,1963.

Tail conoid, tapering to a broadly rounded terminus----------
---------- ----------mirus Siddiqi, 1963.

19- a=58 ------angustus (Butler, 1923) Filipjev, 1936.

a=36-40---dipsaci (Kuhn,1857) Filipjev,1936.

Pseudhalenchus minutus Tarjan,1958.

MEASUREMENTS OF ONE MALE: L = 0.44 mm; a = 36.6; b =4.2; c= 9.3; Spear = 8 µ; Spicules = 14 µ; Gubernaculum = 5 µ.

Although the specimen of Pseudhalenchus minutus Tarjan,1958. isolated from around the roots of Brassica sp. differs from the original measurements as given by its author, but in view of the fact that only one male was isolated, it has therefore, been considered as a geographical variant of P.minutus. This is the first report of this species from India.

Family Neotylenchidae (Thorne,1941) Thorne,1949.

Although some genera such as Neotylenchus Steiner,1931; Hexatylus Goodey,1926; Deladenus Thorne,1941; Paurodontus Thorne, 1941; Stictylus Thorne, 1941; Nothotylenchus Thorne, 1941; Boleodorus Thorne, 1941 and Nothanguina Whitehead, 1959 etc have been reported from soil around the roots of plants and neerotic plant tissues, yet little is known about their parasitic capabilities. Recently Siddiqi (1961) has reported Gymnotylenchus zeae Siddiqi, 1961 from the roots of Zea mays L. from India.

DIAGNOSIS: Tylenchoidea: Cephalic framework in 6 or 8 sectors. Median bulb absent or at best fusiform without valvular apparatus. Posterior part of oesophagus variable, apparantly joining directly with the intestine; an elongated glandular lobe overlapping the intestine for some distance, or a terminal bulb with or without an stem-like extension into the intestine. Female with a single ovary. Bursa adanal, sub-terminal or terminal.

TYPE SUBFAMILY: Neotylenchinae Thorne, 1941.

KEY TO THE SUBFAMILIES OF NEOTYLENCHIDAE

1- Head framework octagonal--------Neotylenchinae Thorne, 1941.
Head framework hexagonal ----------2

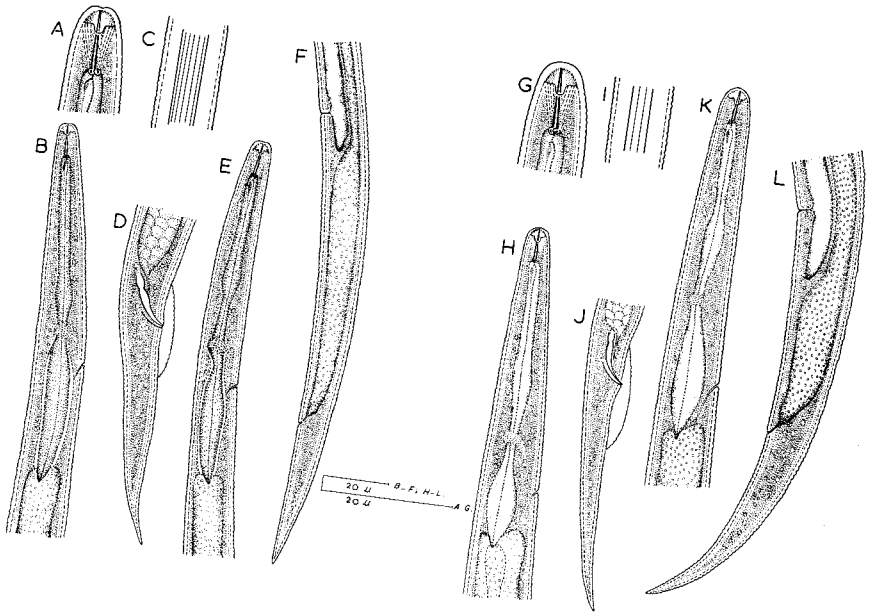
2- Basal oesophageal bulb forming a stem-like basal extension----------Paurodontinae Thorne, 1941.

Basal oesophageal bulb not forming a stem-like basal extension ----------3

Plate No.5.

Fig. A-F. *Paurodontus saxeni* n.sp. A- Female head enlarged; B- Oesophageal region of male; C- Lateral field; D- Male tail; E- Oesophageal region of female; F- Tail end of female.

Fig. G-L. *Paurodontus chowdhuri* n.sp. G- Female head enlarged; H- Oesophageal region of male; I- Lateral field; J- Male tail; K- Oesophageal region of female; L- Tail end of female.


A
C
F
G
I
K
B
E
L
D
H
J
20 µ
B–F, H–L
20 µ
A, G

3- Body exceedingly slender; a = 80-197; bursa flap-like--------
----------Ecphyadophorinae (Skarbilovich,1959)
Goodey, 1963.

Body not exceedingly slender; bursa adanal or terminal------
----------Nothotylenchinae Thorne, 1941.

The subfamily Paurodontinae Thorne,1941.

DIAGNOSIS: Neotylenchidae: Head framework hexagonal. Terminal oesophageal bulb ending in an stem-like extension projecting into the anterior end of the intestine. Bursa adanal or terminal.

TYPE GENUS: Paurodontus Thorne, 1941.

KEY TO THE GENERA OF PAURODONTUS THORNE 1941.

1- Spear knobs symmetrical, bursa adanal----------
----------Paurodontus Thorne, 1941.

Spear knobs asymmetrical, bursa terminal----------
---------- Stictylus Thorne, 1941.

Genus Paurodontus Thorne, 1941.

DIAGNOSIS: Paurodontinae: Spear knobs symmetrical or nearly so. Tails of both sexes long and filiform to short and conoid with acute or sub-acute terminus. Bursae adanal.

TYPE SPECIES: Paurodontus gracilis Thorne, 1941.

Paurodontus saxeni* n.sp.
(Plate No.5;Fig.A-F.)

12 FEMALES; L = 0.59-0.63 mm; a = 34.1-34.9; b = 5.1-6.6; c = 12.1-12.6; V = 78-79%; Spear = 10.0 µ.

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* Named after Dr. S.K. Saxena, Lecturer, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

8 MALES; L = 0.60-0.65 mm; a = 33.8-34.5; b = 5.1-5.5; c = 11.5-12.3; Spear = 10.0 µ; Spicules = 18.6-19.3 µ; Gubernaculum = 7.8-8.3 µ.

DESCRIPTION:- Body ventrally arcuate when relaxed by gentle heat, elongate and cylindrical. Lip region low continuous with the body contour, flattened anteriorly with a slight depression at the oral opening. Spear 10 µ long. Gland opening close to spear base. Corpus a slender tube with less developed basal swelling the valveless metacorpus; Isthmus short. Basal oesophageal bulb spindle-shaped with a short stem-like extension projecting into the intestine. A distinct chamber present surrounding the basal oesophageal bulb. Lateral field marked by six incisures.

Ovary single, prodelphic, outstretched. Oocytes arranged in a single file except for a short region of multiplication. Post-uterine branch sac-like, about one times the vulvar-body width long. Vagina at right angles to the body axis. Vulva-anus distance greater than tail length. Tail tapering to a subacute terminus, nearly five times the anal-body diameter long.

Males similar to females in general appearance. Testis single outstretched. Spicules paired, ventrally acruate, cephalated, 18.6-19.3 µ long. Gubernaculum simple, trough-shaped, 7.8-8.3 µ long. Bursa crenate, slightly more than twice the anal-body diameter. Tail elongate and subacute.

HOLOTYPE: Females, collected in February, 1963, SlideeNo.542, deposited with the Section of Plant Pathology, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of Saraca indica L.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Paurodontus saxeni n.sp. is most similar to P.gracilis Thorne, 1941 due to the presence of a chamber surrounding the basal oesophageal bulb but differs (i) in tail shape, which is sub acute with nearly rounded terminus in the former, whereas it is filiform with acutely pointed terminus in the latter; (ii) c= 11.5-12.6 against 6.5-7.2 in P. gracilis, (iii) Six incisures in the lateral field against four in P.gracilis.

In general appearance it resembles P. similis Siddiqi, 1961 but differs in having a definite chamber surrounding the basal oesophageal bulb.

Paurodontus Chowdhuri* n.sp.

(Plate No. 5; Fig. G-L.)

8 FEMALES: L = 0.75-0.93 mm; a = 34.1-38.7 u; b = 7.8-8.8; c = 11.5-13.2; V = 82.0-83.0%; Spear = 11 µ.

7 MALES: L = 0.67-0.71 mm; a = 33.2-34.1; b = 6.0-6.8; c = 9.0-10.5; Spear = 11 µ; Spicules = 16-17 µ; Gubernaculum = 9.5-10.5 µ.

DESCRIPTION: Body straight when relaxed by gentle heat, elongate and cylindrical. Cuticle annulated. Lip region low, flattened, not set-off from the body contour. Head rounded, but 1/3 as wide as body at the base of oesophagus. Spear tylenchoid with prominent rounded basal knobs, nearly 11 µ long. Gland

* Named after Prof. K.A. Chowdhury, Head, Botany Deptt. A.M.U. A

opening close to spear base. Corpus a slender tube with a weakly developed valveless metacorpus, isthmus long and slender. Basal bulb spindle-shaped with a short extension projecting into the anterior end of the intestine, not surrounded by a chamber. Excretory duct prominent, opening through a cuticularized pore just above the level of the base of the oesophagus. Hemizonid not seen.

Ovary single, prodelphic, outstretched. Oocytes arranged in a single file except for a short region of multiplication. Post-uterine branch sac-like, nearly one vulvar-body width long. Vagina at right angles to the body axis extending about less than 1/4 into the body. Vulva a transverse slit. Vulva-anus distance greater than tail length. Tail tampering to a subacute terminus, about three to four times the anal-body width long.

Males similar to females in general appearance. Testis single, outstretched. Spicules paired, ventrally arcuate and cephalated, nearly 16-17 μ long. Gubernaculum simple, trough-shaped, 9.5-10.5 μ long. Bursa enveloping less than 1/3 of the tail.

HOLOTYPE: Female, collected in April, 1963, slide No.543, deposited with the section of Plant Pathology, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of *Allium cepa* L.

TYPE LOCALITY: University Campus, Aligarh Muslim University, Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Paurodontus chowdhuri n.sp. with the above description and measurements resembles very much P.pimilis Siddiqi , 1961 but differs in the following characters: (1) head about 1/3 as wide as body at the base of oesophagus against 3/7 in P.similis; (2) Post-uterine branch one vulvar-body width long against one and a half times in P.similis; (3) vagina at right angles to body axis, extending about less than 1/4 into the body while in P.similis upto 1/3; (4) tail three to four times the anal-body width long against slightly less than seven in P.similis; (5) gubernaculum 9.5-10.5 μ long against 6.0 μ long in P.similis.

It resembles P.saxeni in tail shape and general appearance but differs considerably in the absence of a chamber surrounding the basal oesophageal bulb.

KEY TO THE SPECIES OF PAURODONTUS THORNE 1941.

(Based on Females)

1- Body length 0.6-0.95 mm; Stem-like extension of the basal oesophageal bulb short, tail elongate----------2

Body length about 0.4 mm; Stem-like extension of the basal oesophageal bulb long, tail conoid, about 3-4 anal-body width long----------3

2- Basal bulb enclosed in a chamber----------4

Basal bulb not enclosed in a chamber ----------6

3- Tail ventral, arcuate, subacute, vulva-anus distance greater than tail length----------P. densus Thorne, 1941.

Tail straight, sharply pointed, vulva-anus distance less than tail length----------7

4- Lateral field marked by six incisures----P.saxeni n.sp.

Lateral field marked by four incisures----------5

5- C = 7.2; V = 76%----------P.gracilis Thorne,1941.

C = 10-12; V = 79-83% ----------P.neosimilis Khan & Basir,1964.

6- Head one third as wide as body at the base of oesophagus, tail 3-4 times the anal-body width long----------P. chowdhuri n.sp.

Head three sevenths as wide as body at the base of oesophagus; tail slightly less than seven times the anal-body width long----------P. similis Siddiqi, 1961.

7- Head two fifths as wide as body at the base of oesophagus; a = 16-22; Post-uterine branch absent----------P.anitions Thorne,1941.

Head three fifths as wide as body at the base of oesophagus; a = 24; Post-uterine branch present----------P. niger Thorne, 1941.

Subfamily Nothotylenchinae Thorne,1941.

DIAGNOSIS: Neotylenchidae: Head framework hexagonal. Oesophageal glands in terminal bulb or in lobes overlapping the anterior part of intestine. Bursa adanal or surrounding tail tip.

TYPE GENUS: Nothotylenchus Thorne, 1941.

KEY TO THE GENERA OF NOTHOTYLENCHINAE THORNE,1941.

1- Cuticle abnormally thick, deeply striated----------
----------Thada Thorne,1941.
Cuticle not abnormally thick, finely striated----------2

2- Spear with distinct flanges----------Boleodorus Thorne,1941.
Spear with distinct basal knobs----------3

3- Females swollen like Anguina; gonads greatly developed; gall forming nematodes----------Nothanguina Whitehead,1959.
Females neither swollen nor gall forming----------4

4- Bursa terminal----------Anguillonema Fuchs,1938.
Bursa adanal or sub-caudal----------5

5- Oesophageal glands forming long lobes---Halenchus Cobb,1933.
Oesophagus with definite basal bulb----------6

6- Tail short conoid and sub-acute; spicula, gubernaculum and bursa ditylenchoid extending to near middle of tail----------
----------Nothtylenchus Thorne,1941.
Tail long and filiform; bursa adanal extending upto 1/7-1/15 of the tail length----------Basiliophora n.gen.

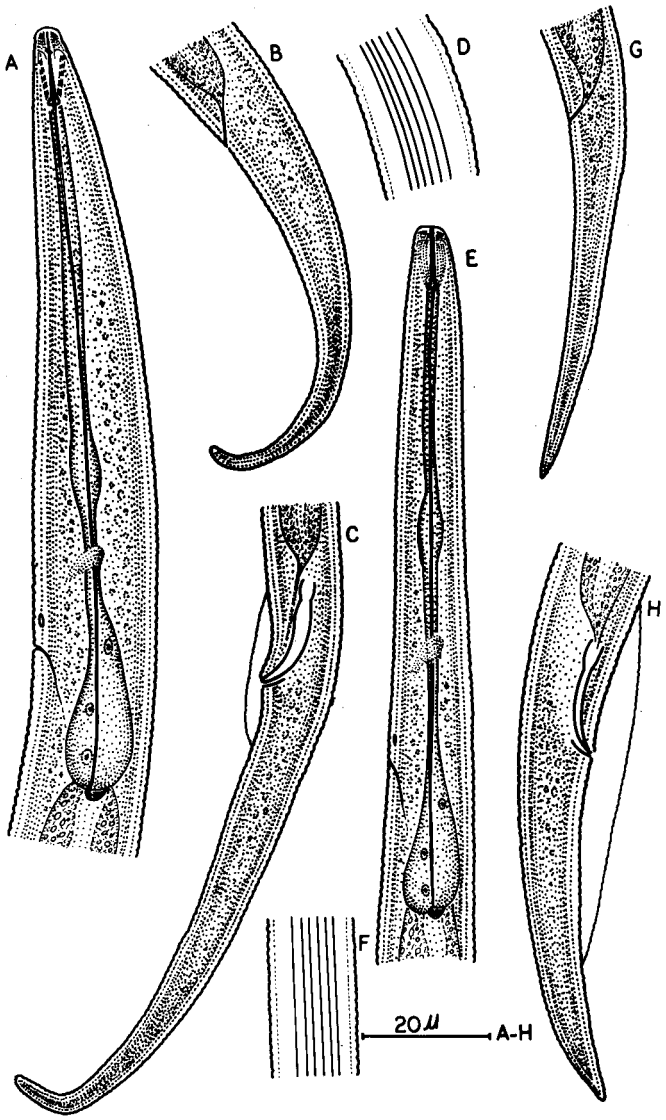
The genus Nothotylenchus Thorne,1941.

DIAGNOSIS: Nothotylenchinae: Head framework hexagonal. Cuticle finely annulated. Lateral field marked by four or more incisures. Spear with roumled basal knobs. Procorpus and corpus cylindrical or fusiform; terminal bulb distinctly setoff from intestine, some times slightly lobed. Ovary single, prodelphic, outstretched.Post-uterine sac present. Spicules and gubernaculum tylenchoid. Bursa extending nearly to middle of tail.

Plate No. 6.

Fig. A-D. *Boleodorus typicus* n.sp. A- Oesophageal region of female; B- Female tail; C- Male tail; D- Lateral field.

Fig. E-H. *Nothotylenchus taylori* n.sp. E- Oesophageal region of female; F- Lateral field; G- Female tail; H- Male tale.


A
B
C
D
E
F
G
H
20 μ
A-H

Nothotylenchus taylori* n.sp.

(Plate No. 6 ; Fig.E-H.)

MEASUREMENTS OF FOUR FEMALES: L = 0.48-0.615 mm; a = 32-41; b = 5.2-6.1; c = 10.0-11.4; V = 75.0-76.9%; Spear = 8-9 µ.

MEASUREMENTS OF TWO MALES: L = 0.60-0.665 mm; a = 28-30; b = 5.1-5.4 ; c = 11.5-12.2; Spear = 8-9 µ; Spicules = 21µ; Gubernaculum = 5-6 µ.

DESCRIPTION: Body cylindrical, ventrally arcuate when relaxed by gentle heat. Cuticle finely annulated. Lateral field marked by six incisures, outer ones being crenate and more prominent, inner ones faint; occupying less than ¼ of the corresponding body width. Lip region low, flattened, narrower than front end of body, continuous with the body contour. Spear short with rounded basal knobs. Orifice of the dorsal oesophageal gland close to spear base. Corpus a slender tube ending in an fusiform valveless median bulb. Isthmus long encircled by a nerve ring near its middle. Basal oesophageal bulb spindle-shaped with three gland nuclei. Cardia rounded. Excretory pore near the beginning of the basal oesophageal bulb. Hemizonid 2-3 body annules long, 2-3 body annules anterior to the excretory pore. Intestinal region granular. Rectum nearly half the anal-body width long. Tail convex-conoid with a rounded tip, 6-7 times the anal-body width long.

Vulva posterior. Ovary single, prodelphic, outstretched with oocytes arranged in a single file except for a short region of

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* Named after Prof. Albert L. Taylor, Ex.Director, U.S.D.A., U.S.A.

multiplication. Post-uterine sac 2-3 times the vulvar-body width long.

Males similar in appearance to females but with more robust body. Testis single, outstretched. Spermatocytes serially arranged. Spicules paired, arcuate and cephalated, nearly 21 µ long. Gubernaculum simple, trough shaped, 5-6 µ in length. Bursa crenate, originating from above the head of the spicules and enveloping more than half the tail. Tail shape as in females.

HOLOTYPE: Female, slide No. 911, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the female; other data same as for holotype.

TYPE HABITAT: Soil around the roots of *Solanum tuberosum* L.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: *Nothotylenchus taylori* n.sp. comes closer to *N.buckleyi* Das, 1960 and *Nothotylenchus affinis* Thorne, 1941. It differs from the former in the smaller and more slender body (L=0.43 mm; a=24.4 in *N.buckleyi*) shorter oesophagus size of the spicules in males and more posteriorly located vulva in females (V = 71-2% in *N.buckleyi*) while from the latter in the size of the post-uterine sac (less than the vulvar-body width long in *N.affinis*), size of the spicules in males and more posteriorly located vulva in females (V= 71% in *N.affinis*)

For Key to the Species of *Nothotylenchus* please see Khan & Basir, 1965.

The genus Boleodorus Thorne,1941.

DIAGNOSIS: Nothotylenchinae: Head framework hexagonal. Cuticle finely annulated. Spear with three prominent flanges instead of knobs. Terminal bulb offset from intestine, may be surrounded by a chamber. Cardia distinct. Ovary single, prodelphic, outstretched with an offset spermatheca. Post-uterine sac present. Spicules and gubernaculum tylenchoid. Bursa adanal.

TYPE SPECIES: Boleodorus thylactus Thorne, 1941.

Boleodorus typicus n.sp.

(Plate No. 6 ; Fig.A-D)

MEASUREMENTS OF SIX FEMALES: L = 0.44-0.575 mm; a = 23-27; b = 3.0-5.3; c = 6.3-9.2; V = 62.5-68%; Spear = 12-14 µ.

MEASUREMENTSOF FIVE MALES : L = 0.52-0.56 mm; a = 33.4-46.6; b = 4.5-5.3; c = 6.6-7.2; Spear = 13-14 µ; Spicules = 18-20 µ; Gubernaculum = 3-5 µ.

DESCRIPTION: Body assumes open C-shape when relaxed by gentle heat tapering on both extremities. Cuticle distinctly annulated. Lateral field marked by six incisures, outer ones being crenate and more distinct, the inner-most difficult to observe, occupying slightly less than 2/5 corresponding body width. Deirids present slightly above the level of excretory pore. Phasmids situated below the middle of the tail. Head continuous with the body

contour, flat and cupolate. Spear 12-14 µ long with broad basal flanges. Orifice of the dorsal oesophageal gland close to spear base. Lip region 2/9 of the body width at neck base. Oesophagus tylenchoid, consisting of a corpus with a posterior fusiform swelling representing the valveless median oesophageal bulb. Isthmus short, encircled by a nerve ring. Basal oesophageal bulb pyriform with three gland nuclei. Excretory duct prominent, opening through a cuticularized pore at 90-100 µ from the anterior end of the body. Cardia small and rounded. Intestine packed with large refractive granules. Rectum about half the anal-body width long.

Ovary single, prodelphic, outstretched with oocytes arranged in multiple rows. Offset spherical spermatheca present. Post-uterine sac about half vulvar-body width long. Vulva-anus distance about twice the tail length. Tail elongate-conoid with rounded terminus, ventrally curved, 5-6 times the anal-body width long.

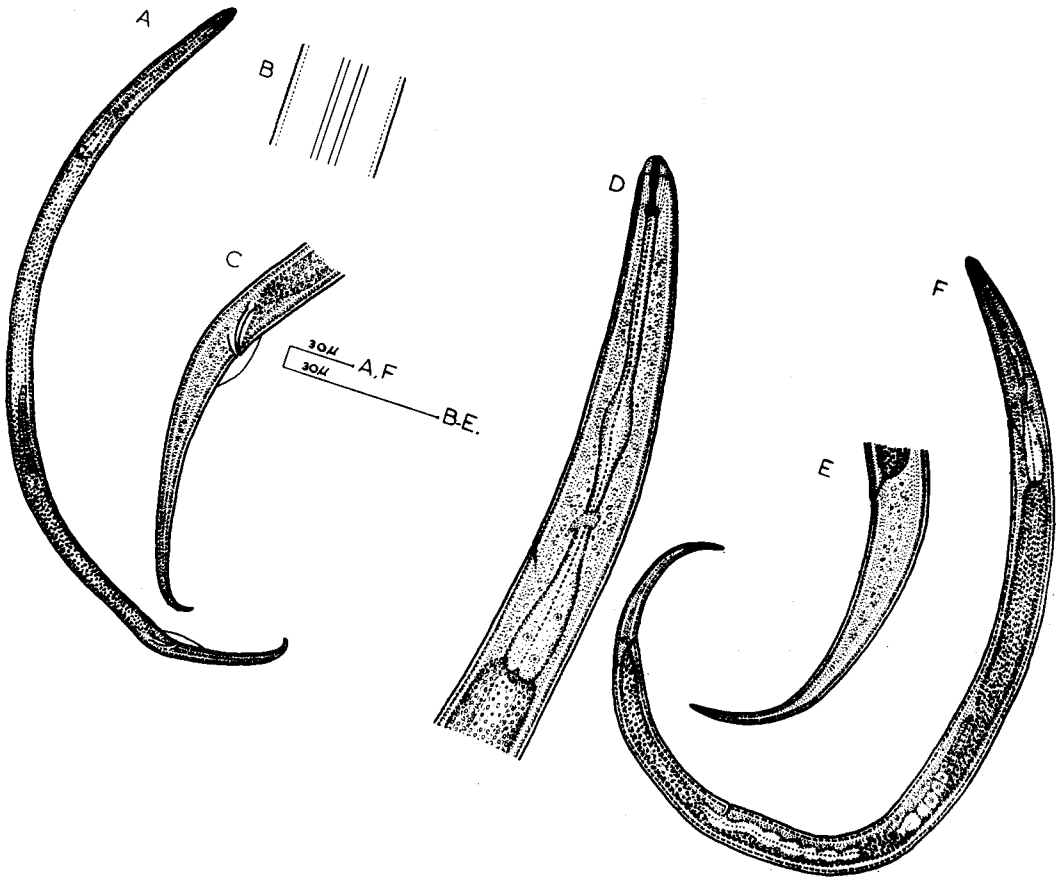
Males similar to females in general shape and appearance. Testis single, outstretched. Spicules paired, cephalated, 18-20 µ long. Gubernaculum short, simple and rudimentary, measuring 3-5 µ in length. Bursa adanal, nearly twice the cloacal body width long.

HOLOTYPE: Female, Slide No. 534; deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

Plate No.7.

Fig. A-F. Boleodorus hyderi n.sp. A- Male; B- Lateral field; C- Male tail; D- Oesophageal region of female; E- Female tail; F- Female.


A
B
C
30μ
30μ
A, F
B-E.
D
E
F

TYPE HABITAT: Soil around the roots of Narcissus sp.

TYPE LOCALITY: Mussoorie, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Boleodorus typicus n.sp. comes closer to B.similis Khan and Basir, 1963 and B.hyderi n.sp. but differs from the former in the size of the spear, size of body, position of phasmid and in possessing six incisures in the lateral field while from the latter in the six incisures in the lateral field, size of the spear and size of the spicules.

Boleodorus hyderi* n.sp.

(Plate No. 7 ; Fig A-F)

MEASUREMENTS OF FEMALES: 15 females; L=0.44-0.50 mm; a = 23-27; b = 4.3-5.0; c = 6.0-7.8; V = 63.6-68.5%; Spear = 10-11 µ.

MEASUREMENTS OF MALE: 1 male; L = 0.38 mm; a = 22; b = 4.1; c = 7.0; Spear 10 µ; Spicules = 12 µ; Gubernaculum = 5 µ.

DESCRIPTION: Body tapering at both extremities, assuming C-shaped appearance when relaxed by gentle heat. Cuticle finely annulated. Lateral field marked by four incisures, occupying 1/4 body-width near vulva. Deirids present slightly above the level of excretory pore. Phasmid situated just below the level of annus. Head continuous with the body contour, flat and cupolate. Stylet 9-11 µ long with basal flanges. Gland opening close to spear base. Lip-region 1/3 of the body-width at neck base. Œsophagus tylenchoid, consisting of a corpus with a posterior fusiform swelling representing the valveless median bulb; isthmus long, encircled by nerve ring at 70 µ from the anterior end of the body. Basal bulb

* Named after Late Dr. Asghar Ali Hyder, Ex.Head of the Deptt. of Botany, Aligarh Muslim University, Aligarh, U.P., India.

pyriform with three gland nuclei. Excretory duct prominent, opening through a cuticularized pore at 75-80 μ from the anterior end. Cardia small and rounded. Intestine packed with large refractive granules. Rectum about 1/3 anal-body width long. Ovary single, prodelphic, outstretched. Post-uterine branch short, half the vulvar-body width long. Oocytes arranged in multiple rows. Spermatheca present. Vulva-anus distance greater than tail length Tail elongate conoid with rounded terminus.

HOLOTYPE: Female collected in February, 1964, Slide No.535 deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male collected with the females, other data same as for holotype.

PARATYPES: Two females in the U.S. Department of Agriculture, Nematode Collection, Beltsville, Maryland, U.S.A. and six females with the author.

TYPE HABITAT: Soil around the roots of *Mangifera indica* L.

TYPE LOCALITY: Dehra Dun, U.P., India.

DIAGNOSIS AND RELATIONSHIP: *B.hyderi* n.sp. comes closer to *B.innuptus* Andrassy, 1961; *B.volutus* Lima and Siddiqi, 1963 and *B.similis* Khan and Br. Basir, 1963 but differs from:

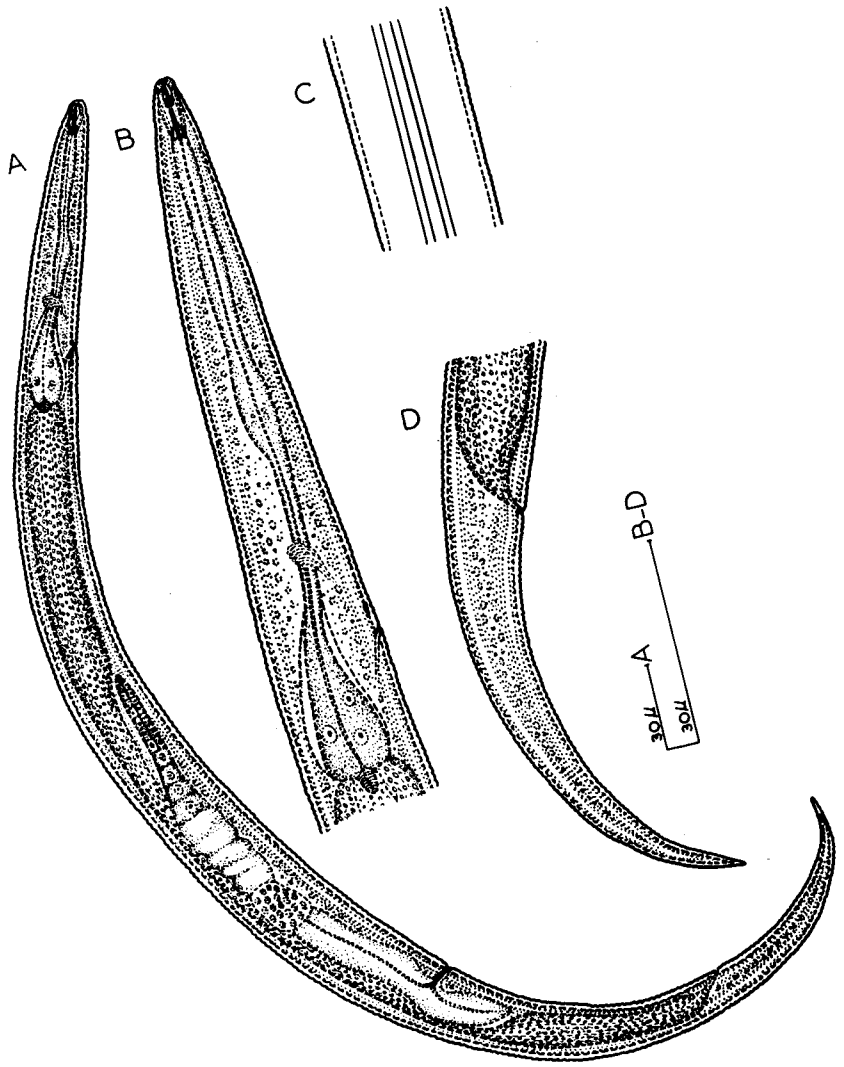
(i) *B.innuptus* in having continuous head and presence of males;

(ii) *B.volutus* in the size of the spear, tail length and in the position of vulva:

(iii) *B.similis* in body size, position of phasmid and in the lateral field occupying less than 1/4 body-width.

Plate No.8.

Fig. A-D. *Boleodorus rafiqi* n.sp. A- Female; B- Oesophageal region; C- Lateral field; D- Female tail.


A
B
C
D
B-D
A
30μ
30μ

Boleodorus rafiqi* n.sp.

(Plate No. 8 ;Fig. A-D.)

MEASUREMENTS: 10 females: L = 0.5-0.6 mm; a = 22-35; b = 4.7-5.0; c = 7.0-10.5; V = 65-68%; Spear = 8-11 µ.

DESCRIPTION: Body C-shaped on death, tapering on both extremities. Cuticle finely annulated. Lateral field marked by four incisures, occupying less than 1/4 body-width at mid-body. Deirids and phasmids not seen. Hemizonid three annules anterior to the excretory pore. Excretory pore 80-90 µ apart from the anterior end of the body. Head continuous with the body contour, flat and cupolate. Lip-region unstriated, 2/5 of the body-width at neck base. Spear 8-11 µ long with basal flanges. Gland opening close to spear base. Œsophagus tylenchoid, consisting of a corpus with a posterior fusiform swelling representing the valveless median bulb; isthmus encircled by nerve ring. Basal bulb pyriform with three prominent gland nuclei, enclosed in a distinct chamber, a unique character in this genus. The distance from the anterior end of the body to the centre of the median bulb slightly less than the distance from the latter to the end of the basal bulb. Cardia distinct, conoid. Intestine packed with large refractive granules. Rectum about 1/3 anal-body width long.

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* Named after Dr. Rafique Ahmad Khan, Ex-Head of the Botany Department, Aligarh Muslim University, Aligarh, U.P., India.

Ovary single, prodelphic, outstretched. Elongate pouch-like spermatheca present. Post-uterine branch short, nearly the vulvar-body width long. Vulva-anus distance greater than tail length. Tail elongate, ventrally arcuate, not hooked, with nearly rounded terminus, tail length 6-7 times the anal-body width.

Male not found.

HOLOTYPE: Female collected in March, 1964, Slide No. 536, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of Pyrus communis L.

TYPE LOCALITY: Srinagar (Kashmir), India.

DIAGNOSIS AND RELATIONSHIP: B.rafiqi n.sp. comes closer to B.pakistanensis Siddiqi, 1963 but differs in the presence of a distinct chamber surrounding the basal bulb and in the position of the dorsal oesophageal gland opening. It can be differentiated from B.thylactus Thorne, 1941 in possessing more posteriorly located vulva and a distinct chamber surrounding the basal oesophageal bulb.

A KEY TO THE SPECIES OF THE GENUS BOLEODORUS THORNE,1941.

1- Tail clavate----------Clavicaudatus Thorne, 1941.

Tail not clavate----------2

2- Basal oesophageal bulb enclosed in a chamber----rafiqi n.sp.

Basal oesophageal bulb not enclosed in a chamber----------3

3- Dorsal oesophageal gland opening far below the base of spear----------pakistanensis Siddiqi, 1963.

Dorsal oesophageal gland opening close to spear base----------4

4- Body slightly arcuate or almost straight, basal oesophageal bulb slightly overlapping the intestine------ ---------- impar Khan, 1964.

Body C-shaped or spiral----------5

5- Lateral field 1/5 body width; tail terminus hooked------- ----------thylactus Thorne, 1941.

Lateral field much more than 1/5 body width; tail terminus not hooked----------6

6- Vulva at 70% of body----------Volutus Lima and Siddiqi,1963

Vulva at less than 70% of body----------7

7- Head set-off; males not known----innuptus (Andrassy,1961) Siddiqi,1963.

Head continuous; males known----------8

8- Lateral field marked by four incisures----------9

Lateral field marked by six incisures------typicus n.sp.

9- Body size 0.44-0.50 mm; phasmids just below the level of anus----------hyderi n.sp.

Body size 0.39-0.44 mm; phasmids three anal-body diameter below the level of anus----similis Khan & Basir,1963.

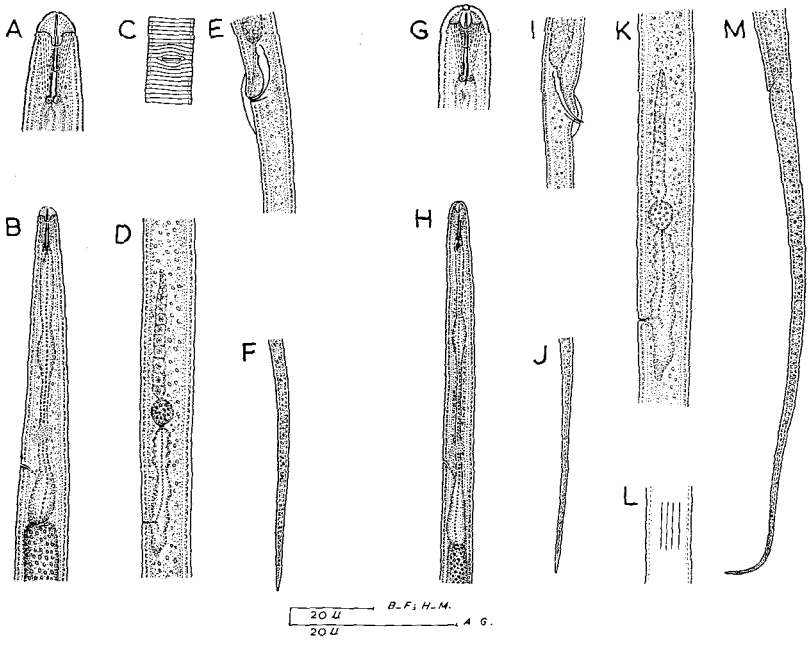
Genus Basiliophora n.gen.

DIAGNOSIS: Nothotylenchinae: cephalic framework hexagonal; head slightly elevated or rounded infront. Spear resembling Ecphyadophora with prominent basal knobs. Gland opening close

Plate No. 9.

Fig. A-F. *Basilionhora indica* n.gen., n.sp. A- Head enlarged; B- Oesophageal region of female; C- Vulva, ventral view; D- Female reproductive region; E- Male reproductive region; F- Portion of female tail.

Fig. G-M. *Basilionhora jonesi* n.gen., n.sp. G- Female head enlarged; H- Oesophageal region of female; I- Male reproductive region; J- Portion of male tail; K- Female reproductive region; L- Lateral field; M- Female tail.


A
C
E
G
I
K
M
B
D
F
H
J
L
20 u
B-F; H-M.
20 u
A G.

to spear base. Corpus with slightly swollen fusiform median bulb. Isthmus long with pyriform basal bulb. Ovary single, prodelphic, outstretched. Vulva-anus distance less than tail length. Bursa extremely short, extending 1/7 to 1/15 of the tail length. Tail 13½ to 22 times the anal-body width long. Incisures present in the lateral field.

TYPE SPECIES: Basiliophora indica.

Basiliophora indica n.gen., n.sp.

(Plate No. 9 ; Fig. No. A-F.)

MEASUREMENTS OF TWENTY FEMALES: L = 0.44-0.51 (0.48) mm ; a = 33.1-34.8 (33.9) ; b = 5.9-6.1 (6.0) ; c = 3.0-3.4 (3.2); V = 55.2-57.0 (56.1) %; Spear = 9.5-10.5 (10.0) µ.

MEASUREMENTS OF TWENTY MALES: L = 0.48-0.50 (0.49) mm; a = 34.8-35.2 (35.0) ; b = 5.9-6.1 (6.0); c = 3.3-3.5 (3.4); Spear = 10-11 (10.5) µ; Spicules = 16-17 (16.5) µ; Gubernaculum = 5.0-5.6 (5.3) µ.

DESCRIPTION: Body straight when relaxed by gentle heat. Cuticle finely annulated. Body elongate, cylindrical and tapering on both extremities. Head slightly elevated, not set-off from the body contour. Spear 9.5-11.0 µ long, resembling Ecphyadophora (de Man 1921) Tarjan, 1957. Gland opening close to spear base. Corpus a cylindrical tube with slightly swollen fusiform median bulb. Isthmus long, surrounded by nerve ring. Basal oesophageal bulb spindle-shaped. Excretory duct prominent, opening through a cuticularized pore at 61-64 µ from the anterior end. Hemozonid present

just anterior to the excretory pore.

Ovary single, prodelphic, outstretched, with oocytes arranged in a single file except for a short region of multiplication. Spermatheca present, somewhat rounded in outline; uterus long, post-uterine branch sac-like, nearly half as long as vulvar-body width. Vulva a depressed transverse slit. Tail large and filiform, nearly 13½ times the anal-body diameter long with rounded terminus.

Males similar to females in general appearance. Head slightly elevated; lip region low, continuous with the body contour. Oesophagus as in females. Testis single, outstretched, spermatocytes serially arranged. Spicules paired, ventrally arcuate and cephalated, 16-17 μ long. Bursa considerably short and crenate extending upto slightly less than 1/7-1/9 of the tail length. Tail elongate and filiform with rounded terminus.

HOLOTYPE; Female, collected on 22 January, 1963; Slide No. 538 deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

PARATYPES: One female and two male paratypes, Slide No. 538 E and 538 F, respectively, deposited with Dr. A.M. Golden, Nematology Investigations, Plant Industry Station, Beltsville, Maryland, U.S.A.

TYPE HABITAT: Soil around roots of *Justicia gendarussa* Burm.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: *Basiliophora indica* n.gen., n.sp.

resembles Ecphyadophora (de Man, 1921) Tarjan, 1957, in general shape and spear characters. It resembles Nothotylenchus Thorne, 1941 with respect to its oesophagus but differs in having filiform tail with rounded terminus and extremely short bursa extending only upto 1/7-1/9 of the tail length.

Basiliophora jonesi* n.gen., n.sp.

(Plate No.9; Fig. G-M.)

20 FEMALES:- L = 0.49-0.58 mm; a = 43.5-45.1; b = 6.1-6.9; c = 3.5-3.8; V = 60.5-62.5%; Spear = 10 µ.

DESCRIPTION: Body straight when relaxed by gentle heat. Cuticle finely annulated. Body elongate cylindrical and nearly of the same diameter from anterior end to vulva. Head rounded infront, very similar to Ecphyadophora. Lip region low, not set off from the body contour. Spear resembling Ecphyadophora with prominent basal knobs, nearly 10 µ long, gland opening close to spear base. Procopus a slender tube ending in a slight fusiform swelling representing the median bulb. Basal bulb pyriform. Nerve ring crossing isthmus. Excretory duct prominent, opening through a pore, nearly 61-65 µ apart from the anterior end. Lateral field with four incisures, outer ones being crenate.

Ovary single, prodelphic, outstretched with oocytes arranged in a single file except for a short region of multiplication. Rounded spermatheca present. Post-uterine branch more than one vulvar-body width long. Tail long and filiform with acute terminus.

Males similar to females in general shape and appearance.

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* Named after Mr. F.G.W. Jones, Head of the Deptt. of Nematology, Rothamsted Experimental Station, Harpenden, Herts, U.K.

Head rounded infront; lip region low, continuous with the body contour. Oesophagus as in females.

Testis single, outstretched; spicules paired, tylenchoid, ventrally curved and cephalated, nearly 16.5-17.5 μ long. Gubernaculum simple 4-5 μ long. Bursa extremely short and crenate, extending only upto 1/13 to 1/15 of the tail length. Tail long and filiform with acute terminus, nearly 22 times the anal-body width long.

HOLOTYPE: Female, collected on 18th May, 1963, Slide No. 539 deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

PARATYPES: One male and three female paratypes deposited with Dr. A.M. Golden, Nematology Investigations, Plant Industry Station, Beltsville, Maryland, U.S.A.

TYPE HABITAT: Soil around the roots of Cynodon dactylon (L) Pers

TYPE LOCALITY: University Campus, Aligarh Muslim University, Aligarh, India.

DIAGNOSIS AND RELATIONSHIP: In general shape and appearance Basiliophora jonesi n.gen., n.sp. resembles Basiliophora indica n.gen n.sp. but differs in the following characters:-
(1) head rounded infront slightly elevated in B.indica; (2) a= 43-51 (a=33-35 in B.indica); (3) V = 60.2-62.5% (V = 55.2-57.0% in B.indica; (4) tail 22 times the anal-body width long against 13½ times in B.indica and ; (5) bursa enveloping 1/13 to 1/15 of the tail length against 1/7 to 1/9 in B.indica.

Plate No.10.

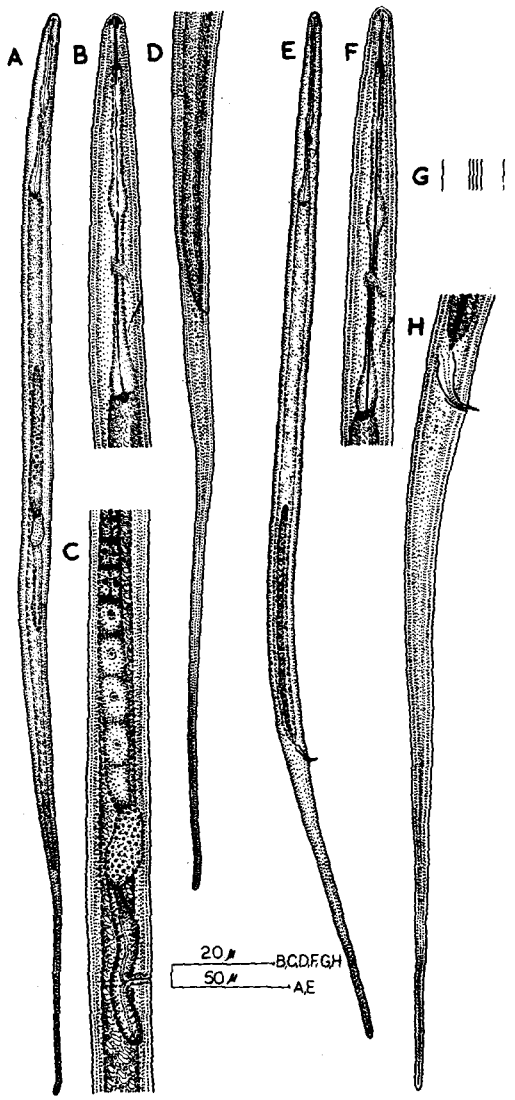
Fig. A-G. Basiliophora longicaudata n.gen., n.sp.

A- Female; B- Oesophageal region of female;

C- Female reproductive region; D- Tail end of female;

E- Male; F- Oesophageal region of male;

G- Lateral field.


A
B
D
E
F
G
H
C
20 μ
B,C,D,F,G,H
50 μ
A,E

Basiliophora longicaudata n.sp.

(Plate No. 10 ;Fig. A-H.)

MEASUREMENTS OF FIFTEEN FEMALES:-

L = 0.45-0.52 mm; a = 40-43; b = 6.2-6.8; c = 4.0-4.8;

V = 50-54%; Spear = 10 µ.

MEASUREMENTS OF FOUR MALES:-

L = 0.45-0.46 mm; a = 40.9-41.3; b = 5.7-6.0; c = 3.3-3.6;

Spear = 10 µ; Spicules = 15-17 µ; Gubernaculum = 4-5 µ.

DESCRIPTION:-

Body straight when relaxed by gentle heat, tapering on both extremities. Cuticle very finely striated. Body elongate, cylindrical and nearly of the same diameter from the anterior end to vulva from where it gradually tapers to form a long filiform tail. Head rounded infront, very similar to Ecphyadophora. Lip-region low, continuous with the body contour. Labial sclerotization absent. Lips obscure, amalgamated. Spear short, in two parts, with rounded basal knobs, nearly 10 µ in length. Orifice of the dorsal oesophageal gland close to spear base. Procorpus a slender tube ending in a fusiform swelling representing the valveless median bulb. Basal bulb pyriform, set-off from the intestine. Cardia rounded, one celled. Isthmus long and slender, encircled by a nerve ring. Excretory pore slightly below the level of nerve ring, situated at 55-65 µ from the anterior end of the body. Deirids situated slightly above the level of excretory pore. Lateral field marked by four incisures, phasmids post-anal, situated

5 μ behind the level of anus. Intestine packed with granules. Rectum short and obscure. Tail long and filiform with rounded tips.

Vulva a transverse slit. Ovary single, prodelphic, outstretched with oocytes arranged in a single file. Elongate-oval spermatheca present. Post-uterine sac one vulvar-body width long.

Males similar to females in general shape and appearance with longer oesophagus and longer tail. Testis single, outstretched, spermatocytes serially arranged. Spicules, paired tylenchoid, ventrally curved and cephalated, nearly 15-17 μ in length. Gubernaculum simple, 4-5 μ long. Bursa could not be traced. Tail shape as in females.

HOLOTYPE: Female, slide No. 540, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of Saccharum officinarum L.

TYPE LOCALITY: Bulandshaher, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Basiliophora longicaudata n.sp. comes closer to B. jonesi n.sp. but differs from it in possessing much anteriorly located vulva and absence of bursa in males.

KEY TO THE SPECIES OF BASILIOPHORA n.gen.

1- Vulva at less than 55%; Bursa absent in males--longicaudata n.sp.
Vulva at 55% or more; short rudimentory bursa present----------
2- a = 33-35; V = 55.2-57.0% ----------indica n.sp.
a = 43-46; V = 60.5-62.5 % ----------jonesi n.sp.

Subfamily Ecphyadophorinae (Skarbilovich,1959)Goodey,1963.
Syn. Ecphyadophoridae Skarbilovich, 1959.

DIAGNOSIS: Neotylenchidae: Head rounded infront or dorsoventrally flattened, not setoff from the body, lips obscure. Head skeleton absent. Body may or may not be annulated and may or may not be narrowing abruptly at vulva. Spear varying between 7-12 μ with rounded basal knobs. Orifice of the dorsal oesophageal gland close to spear base. Oesophagus obscure, more or less cylindrical throughout its length, apparently overlapping the intestine. Spicules needle-like or tylenchoid, ventrally curved ranging between 9-16 μ. Gubernaculum may or may not be present. Bursa flap-like. Tail in both sexes similar.

TYPE GENUS: Ecphyadophora De Man, 1921.

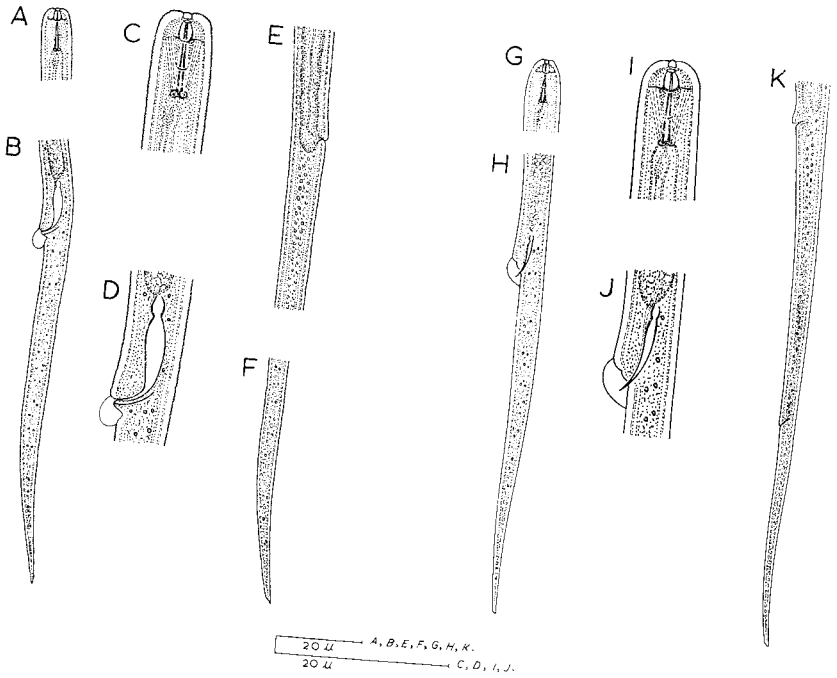
Syn. Ecphyadophoroides Corbett, 1964.

Carbett (1964) has proposed a new genus Ecphyadophoroides to be included in the sub-family Ecphyadophorinae. According to Corbett (1964) Ecphyadophoroides differs from Ecphyadophora in dorso-ventrally flattened head, female body gradually tapering, instead of abrupt narrowing at vulva and spicules in male, short and stout. Ecphyadophora tarjani n.sp. resembles Ecphyadophoroides in general shape and appearance, gradually tapering female body as well as size and shape of the spicules in males. Thus the former differs from Ecphyadophoroides only in the presence of rounded head instead of dorso-ventrally flattened head, a character

Plate No. 11.

Fig. A-F. Ecphyadophora tarjani n.sp. A- Head; B- Male tail; C- Head enlarged; D- enlarged male reproductive regio E- Portion of female reproductive region; F- Portion of female tail.

Fig. G-K. Ecphyadophora goodeyi n.sp. G- Head; H- Male tail; I- Female head enlarged; J- Enlarged male reproductive region; K- Tail end of female.


A
B
C
D
E
F
G
H
I
J
K
20 μ
A, B, E, F, G, H, K.
20 μ
C, D, I, J.

not enough for the separation of the two genera. Hence Ecphyadophoroides has been synonymised with Ecphyadophora.

Genus Ecphyadophora De Man, 1921.
Syn.Ecphyadophoroides Corbett,1964.

DIAGNOSIS: Ecphyadophorinae: Characters as set out in the sub-family.

TYPE SPECIES: Ecphyadophora tenuissima De Man, 1921.

Ecphyadophora goodeyi n.sp.
(Plate No.11; Fig. G-K.)

20 FEMALES:- L = 0.51-0.61 mm; a = 73-76; b = 5.3-5.7; c = 12.8-13.1; V = 73-75%; Spear = 10 µ.

12 MALES:- L = 0.64-0.69 mm; a = 78-81; b = 6.4-6.9; c = 12.7-13.1; Spear = 10 µ; Spicules = 9.0-10.5 µ.

DESCRIPTION: Body exceedingly slender, nearly of the same diameter from the anterior end to the position of vulva or cloaca. Cuticle unstriated. Head rounded infront with a slight depression at the oral opening, lips obscure, lip region low, not set-off from the body contour. Spear tylenchoid with rounded basal knobs, nearly 10 µ long. Oesophagus and oesophago-intetinal junction indistinguishable.

Ovary simple, prodelphic, outstretched, oocytes arranged in a single file. Spermatheca present, oval and elongated. Vulva situated at a point where the body abruptly narrows and easily seen. Post-uterine branch present, about one vulvar-body

diameter long. Tail end in both sexes similar.

Males similar to females in general shape and appearance. Testis single, outstretched. Spicules paired, short, needle-like and slightly curved, nearly 9.0-10.5 μ long. Gubernaculum absent. Bursa distinct. Body narrowing behind the cloaca, continuing as a delicate tail.

HOLOTYPE: Females, collected in January 1963, Slide No. 576, deposited with the Section of Plant Pathology, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

PARATYPES: One male and one female paratype; slide Nos. 576 D and 576 E, respectively, with Dr. A.M. Golden, Nematology Investigations, Plant Industry Station, Beltsville, Maryland, U.S.A.

TYPE HABITAT: Soil around the roots of Solanum tuberosum L.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Ecphyadophora goodeyi n.sp. with the above characters and measurements resembles E.tenuissima (de Man, 1921) ~~Tarjan, 1967~~ in general appearance but differs considerably in (1) a = 73-81 in E.goodeyi against a = 96-197 in E. tenuissima (2) smaller size of the spicules (13-16 μ in E.tenuissima); (3) Post-uterine sac one vulvar-body width long against twice as long as vulvar-body width in E.tenuissima.

Ecphyadophora tarjani*n.sp.

(Plate No.11; Fig.A-F.)

20 FEMALES:- L = 0.84-0.94 mm; a = 77.1-80.2; b = 6.0-6.5; c = 10.5-11.0; V = 74-75%; Spear = 10 µ.

15 MALES:- L = 0.85-0.96 mm; a = 85-88; b = 6.4-6.8; c = 10.0-10.5; Spear = 10 µ; Spicules = 11-14 µ; Gubernaculum = 4-5 µ.

DESCRIPTION:- Exceedingly slender body, nearly of the same diameter from the anterior end to the position of vulva. Cuticle finely annulated. Head rounded infront with slight depression at the oral opening; lip region not set-off; lips obscure and amalgamated. Spear tylenchoid, with prominent, rounded basal knobs, nearly 10 µ long. Gland opening close to spear base. Oesophagus and intestine not easily distinguishable.

Ovary single, prodelphic, outstretched. Oocytes arranged in a single file. Post-uterine branch half as long as vulvar-body width. Body not abruptly narrowed at vulva. Tail in both sexes similar.

Males similar to females in general shape and appearance. Testis single, outstretched. Spicules paired, tylenchoid, ventrally curved, nearly 11-14 µ long, gubernaculum short but distinct, nearly 4-5 µ long. Bursa present. Body narrowing behind the cloaca continuing as a delicate tail.

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* Named After Dr. A.C. Tarjan, Nematologist, Citrus Experimental St Lake Alfred,Florida, U.S.A.

HOLOTYPE: Females, collected on 18th May, 1963, Slide No. 577, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

PARATYPES: Three males and one mmk female, paratypes, Slide No. 577 F with Dr. A.M. Golden, Nematology Investigations, Plant Industry Station, Beltsville, Maryland, U.S.A.

TYPE HABITAT: Soil around the roots of Cynodon dactylon (L.)Pers

TYPE LOCALITY: University Campus, Aligarh Muslim University, Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Ecphyadophora tarjani n.sp. comes closer to E. tennuissima (De Man, 1921) Tarjan, 1957 with respect to its body size but differs considerably in the following characters:-

(1) annulation of the cuticle;

(2) a = 77-88 against 96-197;

(3) body not narrowing abruptly at vulva as in E. tennuissima;

(4) Post-uterine branch half as long as vulvar-body width against twice as long as vulvar-body diameter in E.tennissima;

(5) Spicule

Plate No. 12.

Fig. A-D. Ecphyadophora acuta n.sp. A- Oesophageal region of female; B- Female reproductive region; C- Male tail; D- Female tail.

Fig. E-G. Ecphyadophora vallipuri n.sp. E- Oesophageal region of female; F- Male reproductive region; G- Famale tail. *

Fig. H-L. Ecphyadophora graminis n.sp. H- Details of head; I- Head (dorso-ventral view); J- Lateral field; K- Female tail; L- Male tail.


A
B
E
F
H
I
20 μ
A-L
J
K
L
G
C
D

curved, (tylenchoid) in E.tarjani and needle-like in E.tenuissima and (6) presence of short but distinct gubernaculum.

E.tarjani is similar to E.goodeyi in body width but differs in (1) the greater length of the body; (2) annulation of the cuticle; (3) shape and size of the spicules; (4) the presence of a short but distinct gubernaculum and (5) the absence of abrupt narrowing of the body at vulva.

Ecphyadophora acuta n.sp.
(Plate No.12 ;Fig.A-D.)

MEASUREMENTS OF THIRTEEN FEMALES:- L = 0.57-0.64 mm; a = 76.2-104.1; b = 4.7-7.2; c = 8.2-12.9; V = 68.8-72.9%; spear = 9-10 µ.

MEASUREMENTS OF FOUR MALES:- L = 0.57-0.63 mm; a = 77.5-116.0; b = 5.2-7.2; c = 8.4-8.9; Spear = 9-10 µ; Spicules = 12-16 µ.

DESCRIPTION: Body very slender, cylindrical, nearly of the same diameter from the anterior end to the position of vulva or cloaca from where it narrows slightly to the long tail with acute terminus. Cuticle very finely annulated. Head rounded infront with a slight depression at the oral opening, lips obscure, amalgamated. Lip region smooth, continuous with the body contour. Spear tylenchoid with distinct, rounded basal knobs, nearly 9-10 µ in length. Orifice of the dorsal oesophageal gland close to spear base.

Oesophagus irregularly cylindrical, difficult to distinghish, apparently terminating in a lobe overlapping the intestine. Oesophago-intestinal junction not visible. Nerve ring near middle of oesophagus. Excretory pore 80-90 µ apart from the anterior end of the body.

Vulva a transverse slit. Ovary single, prodelphic, outstretched with oocytes arranged in a single file. Vagina sloping anteriorly inwards. Post-uterine sac half to one vulvar-body width long. Elongate cylindrical spermatheca present, measuring 16 x 3 µ. Phasmids at the level of anus.

Males similar to females in general shape and appearance. Testis single, outstretched. Spicules paired, needle-like, 12-16 µ long. Gubernaculum absent. Bursa forming square to broadly rounded flap extending backwards and enclosing the prominent projection bearing cloaca.

HOLOTYPE: Female, Slide No. 578, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Prunus persica L.

TYPE LOCALITY: Rampur, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Ecphyadophora acuta n.sp. comes closer to E.goodeyi n.sp. and E.quadralata Corbett, 1964, but differs from the former in the more slender body (a = 73-76 in E. goodeyi), anteriorly located vulva (V = 73-75% in E.goodeyi), longer spicules, longer tail (C = 12.8-13.1 in E. goodeyi)

size of the post-uterine sac and in the presence of elongate-cylindrical spermatheca with sperms; while from the latter in the body size, size of the spear, longer oesophagus (b=3.8-5.0 in E.quadralata) size of the spicules, presence of elongate cylindrical spermatheca and absence of gubernaculum.

Ecphyadophora graminis n.sp.

(Palte No.12 ;Fig.H-L.)

MEASUREMENTS OF FIVE FEMALES: L = 0.665-0.70 mm; a = 83.1-97.1; b = 3.8-4.4; c = 4.9-5.4; V = 57.3-60.7%; Spear = 9-10 µ.

MEASUREMENTS OF ONE MALE: L = 0.66 mm; a = 91.2; b = 4.4; c = 4.8; Spear = 9 µ; Spicules = 12 µ; Gubernaculum = 2.5 µ.

DESCRIPTION: Body extremely slender, cylindrical, not abruptly narrowed at vulva. Lateral field marked by four distinct incisures, occupying 2/5 of the body-width. Cuticle finely annulated. Head dorsoventrally flattened, lip region low , smooth, lips obscure, amalgamated. Spear short, in two parts, with asymmetrical rounded basal knobs. Orifice of the dorsal oesophageal gland close to spear base, dorsal knob sloping anteriorly, ventro-submedian ones sloping posteriorly. Oesophagus and oesophago-intestinal junction indistinct, oesophagus a simple tube without median bulb. Nerve ring crossing oesophagus near its middle. Excretory pore 105-115 µ apart from the anterior end of the body. Rectum obscure. Tail long and filiform with acute terminus.

Vulva a transverse slit. Ovary single, prodelphic, outstretched with oocytes arranged in a single file. Vagina sloping anteriorly inwards. Post-uterine sac slightly more than one vulvar-body width long.

Males similar to females in shape and appearance. Testis single with spermatocytes serially arranged. Spicules paired, tylenchoid, arcuate, 12 µ in length. Gubernaculum short but distinct, 2.5 µ long. Bursa flap-like.

HOLOTYPE: Female, slide No. 579, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of # grass.

TYPE LOCALITY: Aligarh, U.P., India.

DISTRIBUTION: This species has also been collected from soil around the roots of Allium cepa L. & Artocarpus integrifolia L. from Aligarh and Muzaffarnagar respectively.

DIAGNOSIS AND RELATIONSHIP: Ecphyadophora graminis n.sp. comes closer to E.valhipuri n.sp. as regards the position of vulva and to E.tenuis (Corbett, 1964) n.comb in view of the dorso-ventrally flattened head but differs from the former in the larger body size and head shape and from the latter in more anteriorly located vulva (V = 65-71% in E.tenuis) and longer oesophagus (b= 4.0-5.7 in E.tenuis).

Ecphyadophora vallipuri n.sp.

(Plate No.12 ;Fig.E-G.)

MEASUREMENTS OF FIVE FEMALES: L = 0.57-0.61 mm; a = 63.3-87.1; b = 4.2-5.6; c = 5.2-5.5; V = 56.2-58.4%; Spear = 7-9 µ.

MEASUREMENTS OF TWO MALES: L = 0.54-0.555 mm; a = 60-61.6; b = 5.3-5.4; c = 5.3-5.4; Spear = 7-8 µ; Spicules = 11-13 µ; Gubernaculum = 1.5-2.0 µ.

DESCRIPTION: Body slender, cylindrical, nearly of the same diameter from the anterior end to the vulva from where it narrows gradually instead of abrupt narrowing. Cuticle annulated. Lateral field marked by four distinct incisures, not interrupted by the cuticular annulations. Head rounded infront with a slight depressio at the oral opening. Lip region smooth, continuous with the body contour; lips obscure, amalgamated. Spear short with rounded basal knobs, 7-9 µ in length. Orifice of the dorsal oesophageal gland close to spear base. Oesophagus and oesophago-intestinal junction indistinct. Oesophagus a simple, irregularly cylindrical tube without median bulb, apparently terminating in a lobe overlapping the intestine. Nerve ring crossing the oesophagus near its middle. Excretory pore at 70-80 µ from the anterior end of the body.

Vulva slightly behind the mid body. Ovary single, prodelphic outstretched with oocytes arranged in a single row. Vagina

sloping anteriorly inwards. Post-uterine sac nearly one vulvar-body width. Spermatheca with sperms present. Rectum obscure; tail long and filiform with acute terminus.

Males similar in appearance to females. Testis single, outstretched with spermatocytes serially arranged. Spicules paired, arcuate, tylenchoid, 11-13 μ long. Gubernaculum short but distinct, 1.5-2.0 μ in length. Bursa flap-like.

HOLOTYPE: Female, Slide No. 580, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Psidium guajava L.

TYPE LOCALITY: Vallipura, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Ecphyadophora vallipuri n.sp. comes closer to E.graminis n.sp. E. tarjani n.sp. and E.quadralata. Corbett, 1964 but differs from (i) E.graminis in the head shape, smaller body size shorter oesophagus (b = 3.8-4.4 in E.graminis); (ii) E.tarjani n.sp. in the smaller body size, position of vulva (V = 74-75% in E.tarjani), longer tail (c = 10.5-11.0 in E.tarjani and smaller size of gubernaculum in males and (iii) E.quadralata in the position of vulva (V = 68-75% in E. quadralata), shorter oesophagus (b= 3.8-5.0 in E.quadralata), shorter spicules and gubernaculum and smaller size of the body.

KEY TO THE SPECIES OF ECPHYADOPHORA DE MAN,1921.

1- Spicules needle-like; gubernaculum absent----------2

Spicules curved, tylenchoid, gubernaculum present----------4

2-a=96-197; Tail terminus sub-acute---*tenuissima* De Man, 1921.
or rounded.
a = 73-104; Tail terminus acute---------- ----------3

3- a = 76.2-104.1; c = 8.2-12.9; V = 68.8-72.9%; Spicules =
12-16 µ ----------*acuta* n.sp.

a = 73-76; c = 12.8-13.1; V = 73-75%; Spicules = 9.0-10.5 µ
----------*goodeyi* n.sp.

4- Head dorso-ventrally flattened----------5

Head rounded infront----------7

5- V = 57.3-60.7%----------*graminis* n.sp.

V = 65-71% ----------6

6- b = 8.8-11.0; c = 7.4-8.4---------*annulata* (Corbett,1964)n.Comb.

b = 4.9-5.7; c = 4.9-6.3 --------*tenuis* (Corbett,1964) n.Comb.

7- L = 0.84-0.94 mm; b = 6.0-6.5; c = 10.5-11.0; v = 74-75%-----
----------*tarjani* n.sp.

L = less than 0.75 mm; b = less than 5.6; c = less than
10.6.----------8

8- L = 0.57-0.61 mm; c = 5.2-5.5; V = 56.2-58.4%----------
----------*vallipuri* n.sp.

L = 0.65-0.74 mm; c = 9.3-10.6; V = 68-75%----------
----------*quadralata* Corbett, 1964.

Family Hoplolaimidae (Filipjev,1934) Wieser,1953.

The members of this family occur more frequently than other nematodes around the roots of most of the plants. They may be ecto-parasitic or endoparasitic. Hoplolaimus galeatus (Cobb,1913) Sher, 1961 feeds on a variety of plants both ecto-and endo-parasitically in the U.S.A. H. basaxophilus (Schuurmans Stekhoven and Teunissen, 1938) H. proporicus Goodey, 1957 occurs inside the roots of Elaeis guineensis in Nigeria and British Cameroons. H.seinhosti Luc, 1958 and H.angustalatus whitehead, 1959 have been reported on cotton and banana roots respectively. The author has found H.indicus Sher, 1961 feeding endoparasitically in the roots of Zea mays L. Scutellonema blaberum (Steiner,1937) Andrassy, 1958 attacks tubers of Yam, Dioscorea species and Helicotylenchus multicinctus (Cobb, 1893) Golden, 1956 parasitizes banana roots. Species of Rotylenchoides Whitehead, 1958 are also root parasites of banana and Drypetes aylmeri Belonolaimus species attack a wide variety of plants viz. Cotton, Clover, Strawberries, Celery, and maize etc. Dolichodorus heterocephalus Cobb, 1914 is a serious root parasite of celery, maize and other plants in the Sout East States of the U.S.A. The last two named genera have not so fa been reported from India. Rotylenchulus species are obligate root parasites of various plant species and its host-range is also fairl wide.

DIAGNOSIS: Tylenchoidea: Head usually with well developed skeleton. Spear and spear knobs well developed. Median bulb of oesophagus ovate to spheroid, well delimited with very well developed musculature and crescentic valve plates. Oesophageal glands overlapping intestine except in Dolichodorus where a definite bulb is present. Body cuticle usually distinctly annulated with lateral field and incisures. Female gonads single or paired. Bursa absent, or present, if present terminal or sub-terminal. Phasmids small or large shield-like structures-scutellae.

TYPE SUBFAMILY: Hoplolaiminae Filipjev, 1934.

KEY TO THE SUBFAMILIES OF HOPLOLAIMIDAE

1- Basal part of oesophagus bulbar---Dolichodorinae Chitwood & Chitwood, 1950.

Basal part of oesophagus glandular----------2

2- Gonads paired----------3

Gonad single----------Rotylenchoidinae Whitehead, 1958.

3- Head show sexual dimorphism; cephalic framework usually with strong sclerotization; spear 2-4½ times head width long----------Hoplolaiminae Filipjev, 1934.

Head four lobed, spear considerably long--Belonolaiminae Whitehead,

Subfamily Hoplolaiminae Filipjev, 1934.

DIAGNOSIS: Hoplolaimidae: Heads show sexual dimorphism. Spear and spear knobs well developed, 2-4½ times head width long. Oesophageal glands forming lobes overlapping the anterior end of intestine. Cardia present. Ovaries paired, opposed and outstretched. Vulva median. Females tail less than two anal-body widths long. Lateral field marked by four or less incisures. Bursa surrounding male tail, except in Rotylenchulus.

TYPE GENUS: Hoplolaimus Daday, 1905.

KEY TO THE GENERA OF HOPLOLAIMINAE

1- Females swollen, kidney-shaped----------Rotylenchulus Linford & Oliveira, 1940.

Females vermiform----------2

2- Phasmids large, scutellum-like----------4

Phasmids small, pore-like----------3

3- Oesophageal gland overlap greatest on ventral side----------Helicotylenchus Steiner, 1945.

Oesophageal gland overlap greatest on dorsal side----------Rotylenchus Filipjev, 1936.

4- Phasmids posterior to vulva----------5

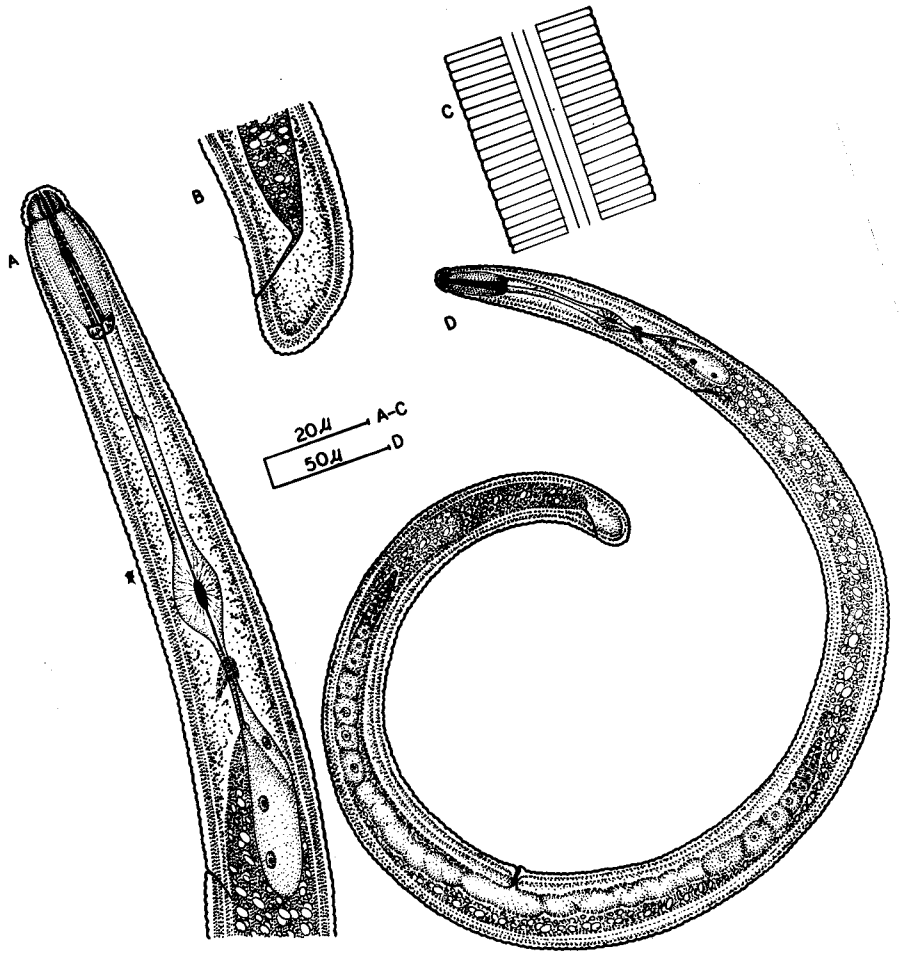
One phasmid anterior and the other posterior to vulva----------6

5- Lip region with horizontal and with or without longitudinal striations; phasmids located opposite or nearly opposite one another near anal-region----Scutellonema Andrassy, 1958.

Lip region without striations; phasmids located in posterior part of the body, not opposite one another, above the tail----------Peltamigratus Sher, 1964.

Plate No.13.

Fig. A-D. Rotylenchus helicus n.sp. A- Oesophageal region of female; B- Female tail; C- Lateral field; D- Female.


A
B
C
D
20μ
A-C
50μ
D

6- Body slightly curved on death; lip region well setoff, labial-disc well developed and conspicuous----------
----------Hoplolaimus Daday, 1905.

Body spiral or open C-shaped on death; lip region slightly or not setoff, labial disc small or inconspicuous----------
----------Aorolaimus Sher,1963.

Genus Rotylenchus Filipjev,1936.

DIAGNOSIS: Hoplolaiminae: Lip region with longitudinal striae producing aerolation of some or most of the annules. Lateral field with four incisures. Phasmids small and on tail end. Orifice of dorsal oesophageal gland $\frac{1}{4}$-$\frac{1}{2}$ spear length from spear base. Oesophageal glands overlap intestine mostly dorsally as well as laterally and ventrally. Female tail rounded or slightly dorsally convex. Gonads with or without spermathecae. A 'telamon' may be present between the spicules.

TYPE SPECIES: Rotylenchus robustus (De Man,1876) Filipjev,1936.

Rotylenchus helicus n.sp.

(Plate No.12 ;Fig.A-D.)

MEASUREMENTS OF TWENTY FEMALES: L = 0.66-0.86 mm; a = 26-30; b = 4.9-6.7; c = 55.5-92.5; V = 55.4-70.2%; Spear = 28-32 μ.

DESCRIPTION: Body spirally curved when relaxed by gentle heat. Cuticle distinctly annulated, annules 2 μ apart at mid-body. Lateral

field marked by four crenate incisures, measuring 2/9 of the corresponding body width; outer incisures more distinct than the inner ones. Lip region slightly setoff, if at all, with five labial annules, hemispherical. Labial sclerotization moderate. Spear well developed with anteriorly concave and posteriorly convex knobs, anterior part of the spear slightly shorter than the posterior part. Orifice of the dorsal oesophageal gland more than half the spear length behind the spear base, measuring 15-18 μ behind the spear base. Procorpus cylindrical ending in oval median bulb with well developed valvular apparatus. Nerve ring crossing the isthmus just behind the median bulb. Excretory pore much behind the level of nerve ring, just near the end of the glandular oesophagus. Oesophageal glands overlapping the intestine dorsally, laterally and ventrally, typically the greatest overlap dorsally. Intestinal portion granular. Rectum distinct, slightly less than the anal-body width long. Phasmids 3-5 annules posterior to anus. Tail convex-conoid with broadly rounded terminus, ½-3/4 anal-body width long. Tail annules numbering 8-10 ventrally.

Ovaries paired, opposed and outstretched. Spermatheca not seen. Spermogonium present, Epitygma distinct. Oocytes arranged in a single file except for a short region of multiplication.

Males not found.

HOLOTYPE: Female, slide No.361, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University

Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of Psidium guajava L.

TYPE LOCALITY: Rampur, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Rotylenchus helicus n.sp. comes closer to R.orientalis Siddiqi and Husain, 1964 and R.quartus (Andrassy, 1958) Sher, 1961. It differs from the former in the size of the spear, tail length, position of phasmid, distinct epitygma and in possessing normally developed ovaries (Posterior ovary reduced in R.orientalis). It differs from the latter in the shape of head, tail length, number of tail annules, position of vulva and the location of dorsal oesophageal gland opening.

Although very recently Sher, 1965 has given an upto-date key for the species of the genus Rotylenchus but somehow he failed to include R.orientalis Siddiqi and Husain, 1964 in the key. As the author has described one more new species of this genus, It was, therefore, considered proper to revise Sher's key, which is presented below:

KEY TO THE SPECIES OF THE GENUS ROTYLENCHUS

1- Lateral field incompletely annulated----------
----------robustus (De Man,1876) Filipjev,193
Lateral field aerolated only anteriorly----------2

2- Oesophageal glands overlapping intestine only slightly (three or less body annules); lip region truncate----------
----------breviglans Sher, 1965.

. Oesophageal glands overlapping intestine four or more body annules, lip region hemispherical----------3

3- Lip region with six or more annules----------4

Lip region with five or less annules----------5

4- Phasmids on tail------*quartus* (Andrassy,1958) Sher, 1961.

Phasmids above tail--*fallorobustus* (Goodey,1932) Sher,1965.

5- Lip region with two or less annules---*calvus* Sher, 1965.

Lip region with three or more annules----------6

6- Spermatheca with sperm, males present----------10

Spermatheca absent or without sperm, males absent----------7

7- Spear 33 μ or longer; tail terminus usually with slight ventral projection----------*buxophilus* Golden,1965.

Spear 32 μ or less; tail terminus hemispherical----------8

8- Orifice of the dorsal oesophageal gland at more than half the length of the spear behind the spear base----------9

Orifice of the dorsal oesophageal gland at less than $\frac{1}{4}$ spear length behind the spear base------*unisexus* Sher, 1965.

9- Phasmids post-anal; both ovaries normally developed; c = 55.5-92.5----------*helicus* n.sp.

Phasmids pre-anal; posterior ovary reduced; c = 36-56----------*orientalis* Siddiqi and Hussain, 1964.

10- Excretory pore posterior to level of oesophago-intestinal valve----------*gracilidens* (Sauer, 1958) Sauer,1958.

Excretory pore at or anterior to level of oesophago-intestinal valve----------11

11- Spear 36 μ or longer; anterior portion of cuticle with prominent irregular longitudinal striations----------rugatocuticulatus Sher, 1965.

Spear 34 μ or shorter; anterior portion of cuticle with irregular longitudinal striations sparse or absent--------12

12- Lip region with five annules, without longitudinal striations; phasmids always located on tail----------caudophasmidius Sher, 1966.

Lip region with four or less annules, with longitudinal striations; phasmids usually located anterior to tail------13

13- Female tail terminus irregularly hemispherical, annulation often irregular; phasmids often on tail----------pumilus (Perry, 1959) Sher, 1961.

Female tail terminus hemispherical, annulations usually regular; phasmids always above tail----------14

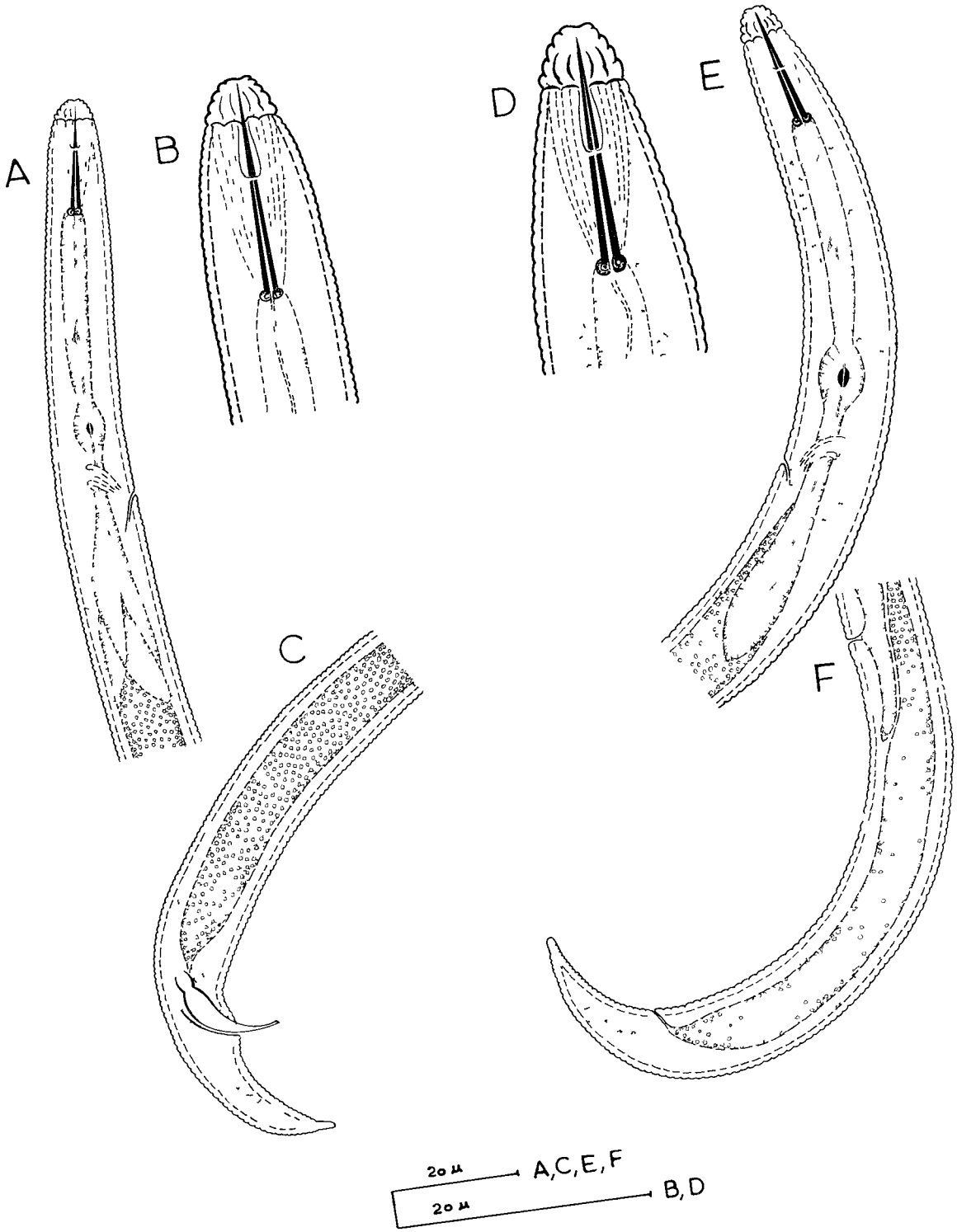
14- Intestine overlaps rectum, median bulb almost round----------brevicaudatus Colbran, 1962.

Intestine does not overlap rectum; median bulb elongate----------1

15- Phasmids 10 or less annules above anus level; anterior portion of cuticle usually with irregular longitudinal striations----------goodeyi Loof and Oostenbrink, 1958

Plate No. 14.

Fig. A-F. *Rotylenchulus stakmani* n.sp. A- Oesophageal region of male; B- Male head enlarged; C- Male tail; D- Female head enlarged; E- Oesophageal region of female; F- Tail end of female.


A
B
C
D
E
F
20 µ
A,C,E,F
20 µ
B,D

Phasmids 11 or more annules above anus level; anterior portion of cuticle without irregular longitudinal striations----------incultus Sher, 1965.

Genus Rotylenchulus Linford and Oliveira,1940.
Syn.Spirotylenchus Lordello & Cesnik,1958
Leiperotylenchus Das, 1960.

DIAGNOSIS: Hoplolaiminae: Sexually dimorphic, female being swollen to kidney-shape,male vermiform. Orifice or dorsal oesophageal gland about half way between spear base and median bulb. Females with two ovaries and post-median vulva. Oesophageal glands in a lobe overlapping intestine. Male with rather weak spear and reduced oesophagus.

TYPE SPECIES: Rotylenchulus reniformis Linford and Oliverra, 1940.

Rotylenchulus stakmani* n.sp.

(Plate No. 14 ;Fig.A-F.)

20 IMMATURE FEMALES: L = 0.37-0.46 mm; a = 13.5-22.7; b = 2.9-4.5; c = 14.5-15.6; V = 66-72%; Spear = 19-20 µ.

15 MALES: L = 0.41-0.49 mm; a = 27.3-29.7; b = 4.2-4.6; c = 14.2-14.7; Spear = 16-17 µ; Spicules = 21-22 µ; Gubernaculum = 10-11 µ.

DESCRIPTION: Body small, forming an open spiral when killed by gentle heat. Cuticle finely annulated. Head framework sclerotized Lip region continuous with the body contour. Sexual dimorphism in head, spear and oesophageal character distinct. Spear well

* Named after Prof. E.C. Stakman, Prof., Emeritus,Deptt. of Plant Pathology & Botany,Institute of Agriculture,University of Minnesota, St. Paul 1, U.S.A.

developed with prominent rounded basal knobs, 19-20 μ long. Gland opening slightly more than one stylet length behind the base of stylet. Corpus a slender tube ending in an oblong median oesophageal bulb with well developed crescentic valves. Excretory pore situated at less than half the length of the isthmus. Nerve ring present at the level of excretory pore. Basal portion of oesophagus ending as a glandular lobe, overlapping the intestine. Intestine packed with dense food granules.

Vulva not very prominent. Ovaries appear to be paired but the cells of the ovaries not well developed. Tail ventrally arcuate, more than twice the anal-body width long, tapering uniformly to a rounded terminus. Number of tail annules ranging from 24 to 27.

Males similar to young females in general appearance with somewhat more slender body than young females, with less massive cephalic framework, shorter stylet with feebly developed knobs; less developed median oesophageal bulb with faint crescentic valves as compared to young females. Testis single, outstretched. Spicules slender, slightly arcuate and cephalated, 21-22 μ long. Gubernaculum simple, 10-11 μ long. Tail shape as in females with 21-23 annules. Bursa absent.

HOLOTYPE: Male, Slide No. 391, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University Aligarh, U.P., India.

ALLOTYPE: Female, collected with the males, other data same as for holotype.

PARATYPES: Some males and some females, paratypes deposited w: Dr. A.M. Golden, Nematology Investigations, Plant Industry Statio: Beltsville, Maryland, U.S.A. and with Dr. S.A. Sher, Citrus Research Centre, California, Riverside California, U.S.A.

TYPE HABITAT: Soil around roots of Solanum tuberosum L.

DIAGNOSIS AND RELATIONSHIP: Rotylenchulus stakmani n.sp. resembles R.reinformis Linford and Oliveira,1940 in the position of vulva in young females but differs in (1) the gland opening slightly more than one stylet length behind the base of stylet; (2) absence of bursa in males and ; (3) c = 14.2-14.7 in males against c = 11.8 in R. reinformis.

It also differs from R. borealis Loof and Oostenbrink 1962, in having more posteriorly located vulva (57.6-64.8% in R.borealis); tail more than twice the anal-body width long; and meaurements of the tail, c = 14.2-15.6 as compared with c = 11.3-14.8 in R. borealis.

KEY TO THE SPECIES OF ROTYLENCHULUS LINFORD AND OLIVEIRA, 1940.

1- Vulva in immature females at 58-65%----------
----------R.borealis Loof and Oostenbrink, 1962.
Vulva in immature females at 66-72%----------2

2- Males with bursa, adult females known----------
----------R.reniformis Linford and Oliveira, 1940.
Males without bursa, adult females unknown----------
----------R.stakmani n.sp.

Family Criconematidae (Taylor,1936) Thorne,1949.
Syn. Ogmidae Southern, 1914,
Macroposthonidae Skarbilovich, 1959.

Members of this family are usually found associated with the roots of forests, fruit trees and certain other crops. They are supposed to feed on young root tips. Although the stylet is very long in proportion to body length, yet the convincing evidence about their parasitism has been obtained only in a few cases (Steiner, 1942, printed, 1949 and Van Gundy, 1957).

Some of the inconsistencies that existed about the family Criconematidae have been removed as a result of publications by Siddiqi and Goodey (1963), De Grisse (1964) and ~~Loof and~~ De Grisse and Loof (1965).

DIAGNOSIS: Tylenchoidea: Procorpus and median oesophageal bulb amalgamated, crescentic thickenings well developed, posterior part of oesophagus ~~is~~ spathulate or rounded terminal bulb; isthmus may be reduced. Spear well developed and often very long in females, its anterior portion being the longer. Cuticular annulation usually thick, simple or retrorse, with or without scales or spines. Cuticle double in adult females of two genera Viz. Hemicriconemoides and Hemicycliophora. Male often with reduced or absent spear and oesophagus and with simple body annulation. Vulva posterior, ovary single and prodelphic. Spermatheca when present, in the form of a thin-walled offset pouch at the distal end of the uterus. Male bursa present or absent

TYPE SUBFAMILY: Criconematinae Taylor, 1936.

KEY TO THE SUBFAMILIES OF CRICONEMATIDAE

1- Cuticle of female strongly annulated; isthmus absent or short and broad----------2

Cuticle finely annulated; isthmus narrow and distinct----------Paratylenchinae Thorne, 1949.

2- Spear knobs anchor-shaped-----Criconematinae Taylor, 1936.

Spear knobs spheroid----------Hemicycliophorinae Skarbilovich, 1959.

Subfamily Hemicycliophorinae Skarbilovich, 1959.

DIAGNOSIS: Criconematidae: Basal knobs of spear spheroid. Body with well marked annulations, not retrorse. Cuticular sheath present in Hemicycliophora. Lateral fields may be present. Oesophagus with isthmus more or less amalgamated with the terminal bulb to form almost, a slightly swollen cylinder. Tails of both sexes similar, elongate-conoid to filiform or conical-rounded. Males rare, without spear and with only a single cuticle. Spicules almost straight, sickle-shaped or hooked. Adanal bursa present or absent.

TYPE GENUS: Hemicycliophora De Man, 1921
Syn. Procriconema Micoletzky, 1925.

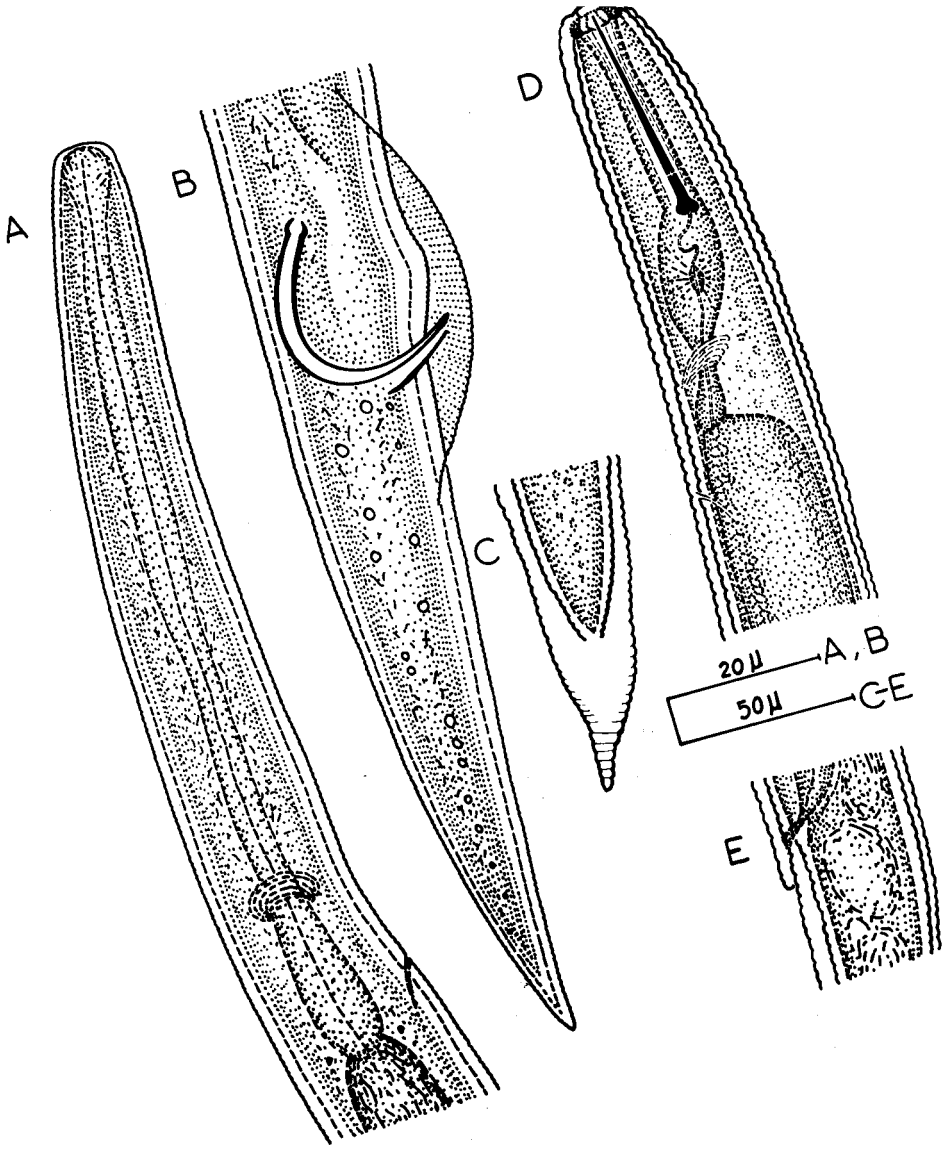
KEY TO THE GENERA OF HEMICYCLIOPHORINAE

1- Cuticle in adult female single and thick--Caloosia Siddiqi and Goodey, 1963.

Cuticle in adult female double--Hemicycliophora De Man, 1921.

Plate No. 15.

Fig. A-E. *Hemicycliophora dhirendri* n.sp. A- Head end of male; B- Male tail; C- Female tail (ventral); D- Head end of female; E- Vulvar region.


A
B
C
D
E
20 µ
A, B
50 µ
C-E

Genus Hemicycliophora De Man,1921.

DIAGNOSIS: Hemicycliophorinae: Basal knobs of spear spheroid, enclosing a cavity at the base. Cuticle double in adult female, the inner one apparently being a fifth produced after the fourth molt. Sheath attached at the head, vulva and sometimes at the tail end. Annules on both cuticles plain, rounded, not retrorse. Lateral fields sometimes present on sheath and not completely interrupting the transverse striae. Longitudinal striae sometimes present on sheath. Head flat, not offset, with a few annules and and labial disc. Isthmus and terminal bulb forming a cylinder that is slightly swollen posteriorly. Tails elongate, pointed or rounded, of varying lengths. Males rare, without spear, without sheath, cuticular annulation finer. Oesophagus degenerate, but nerve ring, excretory pore and hemizonid visible. Spicules usually sickle-shaped. Bursa and gubernaculum present. Spicules protrude through a prominent cloacal sheath. Development via juveniles possessing a sheath.

TYPE SPECIES: Hemicycliophora typica De Man, 1921.

Hemicycliophora dhirendri* n.sp.

(Plate No..15 ;Fig.A-E.)

MEASUREMENTS OF SIX FEMALES: L = 0.64-0.77 mm; a = 15.5-23.5; b = 5.2-6.3; c = 11.2-11.8; V = 80.4-84.5%; Spear = 60-70 µ; Total number of body annules = 200-240.

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* Named after Dhirendra Prakash, my colleague, who helped me in various ways.

MEASUREMENTS OF TWO MALES: L=0.56-0.64 mm; a = 20.0-26.6; b= ?; c= 7.0-7.2; Spicules = 40-41 μ; Gubernaculum = 10 μ.

DESCRIPTION: Body remains almost straight on death or assumes a slightly ventrally arcuate shape; cylindrical, almost of the same diameter upto vulva from where it narrows uniformly into an elongate conical tail. Fifth cuticle of the body not much loose. Cephalic framework moderately sclerotized. Lip region continuous with the body contour, flat and rounded with one or two annules. Lateral field consists of a single line, crossed by transverse annulations and forming rectangular blocks. Spear well developed, slightly arcuate with posteriorly backward flattened knobs, extending upto 18-20 annules of the body; spear tip 45-48 μ long. Orifice of the dorsal oesophegeal gland 7 μ from the spear base. The whole spear is enclosed by the procorpus of the oesophagus which is fused with the metacorpus. Isthmus short expanding to form a pyriform basal bulb. Nerve ring encircles the isthmus. Hemizonid not seen. Excretory pore 4-6 annules posterior to the base of the oesophagus i.e. on 38th to 42nd body annule.

Ovary monodelphic, prodelphic and outstretched with oocytes arranged in a single row except for a short region of multiplication. Prominent spherical, setoff spermatheca present. Sperms filled in the spermatheca. Vulva opens under a folded skirt of second cuticle. Tail conical with rounded terminus.

Male cuticle marked by fine transverse striae. Lateral field marked by two crenate incisures becoming invisible after cloaca. Lip region slightly expanded. Spear absent. Pharynx with slight sclerotization forming a chamber. Testis single, outstretched. Spicules sickle-shaped, as illustrated. Bursa crenate, less than two times as long as body-width. Tail conoid with a rounded terminus.

HOLOTYPE: Female, collected in October, 1964, slide No.661, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Cyperus rotundus L.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: Hemicycliophora dhirendri n.sp. comes closer to H.oostenbrinki Luc.1958; H.typica De Man, 1921 and H.uniformis Thorne,1955. It differs from H.oostenbrinki in the absence of longitudinal lines, hemizonid and the tubular sheath covering the spicules. It also differs in the tail shape and size of the spicules. It differs from H.typica in the size of the spear, lateral field, male body-width and in having the vulva under a folded skirt. From H.uniformis it differs in lesser number of body annules and smaller size of the females.

KEY TO THE SPECIES OF HEMICYCLIOPHORA
(Modified after Thorne,1955)

1- Body annules less than 200 in number----------

Body annules 200 or more in number----------

2- Sheath with about 30 longitudinal rows of rectangular blocks----------*transvaalensis* Heyns,1962.

Sheath without longitudinal rows of rectangular blocks-------

----------*brevicauda* Sauer, 1958.

3- Head annules distinctly separated----------

----------*hesperis* Raski, 1958.

Head annules not distinctly separated----------

4- Labial disc present----------

Labial disc not prominent----------

5- Caudal terminus acute or sub-acute----------6

Caudal terminus blunt, rounded----------2

6- Tail long, attenuated----------7

Tail not attenuated----------8

7- Neck cylindroid to truncate lip-region;annules 256-263-------

----------*paradoxa* Luc, 1958.

Neck tapering to rounded lip-region----------

----------*gigas* Thorne, 1955.

8- Body slender, a=26-38----------9

Body robust----------10

9- Body length 1.0 mm ----------*arcuata* Thorne, 1955.

Body length 1.4 mm ----------*tenuis* Thorne, 1955.

10- Body marked by longitudinal striae----------

Body not marked by longitudinal striae----------

11- Tail uniformly conoid----------

Tail not uniformly conoid----------

12- Lateral field with single row of rectangular blocks--------

----------penetrans Thorne, 1955.

Lateral field with double row of rectangular blocks--------

----------Oostenbrinki Luc, 1958.

13- Annules less than 280----------1

Annules over 300 ----------indica Siddiqi, 1961.

14- Annules 200 ----------membranifer Micoletzky, 1925.

Annules 256-280----------thornei (Thorne,1955)Goodey, 1963.

15- Cuticle ornamented with delicate longitudinal markings-----

----------aquaticum(Micoletzky,1913)Loos,19

Cuticle not ornamented with longitudinal markings----------16

16- Body tapering uniformly from vulva to sub-acute terminus---17

Body not tapering uniformly----------21

17- Vulva-terminus distance three times spear length----------

----------parvana Tarjan,1952.

Vulva-terminus distance twice or less as long as spear-----18

18- Lip region narrow rounded----------19

Lip region broad, truncate----------20

19- Total body annules 276-303; body length 0.9 mm ----------

----------uniformis Thorne, 1955.

Total body annules 200-240; body length 0.64-0.77 mm-------

----------dhirendri n.sp.

20- Lateral field marked by incisures---*conida* Thorne,1955.

Lateral field without incisures-----*pauciannulatus* Luc,1958.

21- Body length 1.? mm ----------22.

Body length 1.7 mm ----------*gracilis* Thorne, 1955.

22- Males abundant----------*typica* De Man, 1921.

Males as far as known absent----------23.

23- Spear 90-104 μ long----------*similis* Thorne, 1955.

Spear 112-122 μ long----------*vidua* Raski, 1958.

24- Terminus convex or irregular, conoid to blunt----------25.

Terminus hemispheroidal----------30.

25- Head setoff by a constriction---------*truncata* Colbran,1956.

Head continuous----------26.

26- Tail uniformly convex-conoid----------27.

Tail irregularly conoid to blunt terminus----------29.

27- Vulva terminus distance less than spear length----------28.

Vulva terminus distance more than spear length----------

----------*obesa* Thorne, 1955.

28- Spear 116-120 μ long----------*brevis* Thorne,1955.

Spear 69-83 μ long ----------*epicharis* Raski, 1958.

29- About 20 annules between vulva and terminus----------

----------*aberrans* Thorne, 1955.

About 55 annules between vulva and terminus----------

----------*striatula* Thorne,1955.

30- Body length 1.2 mm ----------*rotundicauda* Thorne,1955.

Body length 0.8 mm ----------31.

31- Body with ventral contraction at vulva----------32

Vulva continuous with the body contour----*nana* Thorne,1955.

32- Spear 82-103 µ long----------33

Spear 120 µ long----------*obtusa* Thorne,1955.

33- V= 89-92% ----------*arenaria* Raski,1958.

V= 77-86% ----------34

34- Body length 1.0-1.6 mm; Body annules 385-420; b=6.4-8.7---

----------*euginae* Khan and Basir,1963

Body length 0.89-1.1 mm; body annules 320-355; b=4.6-6.1--

----------*tarjani* Khan and Basir, 1963

35- V= 74-82% ----------37

V= 82-87% ----------36

36- Body length 1.18-1.50 mm; Lip region with labial disc 2/5 as wide as head, bearing one annule----------

----------*mettleri* Jenkins and Reed, 1964.

Body length 0.86-1.13 mm; lip region with labial disc about 1/3 as wide as head, bearing three annules----------

----------*silvestris* Jenkins & Reed,1964.

37- Spermatheca and post-uterine sac present----------

----------*ritteri* Brizuela, 1963.

Spermatheca and post-uterine sac absent ----------

----------*vaccinium* Reed & Jenkins,1963.

The following two species could not be included in the Key due to unavaildbility of literature:-

1- *H.labiata* Colbran, 1960.

2- *H.ovata* Colbran, 1962.

Family Heteroderidae (Filipjev, 1934) Skarbilovich,1947
Syn. Heteroderinae Filipjev, 1934,
Meloidogyninae Skarbilovich,1959.

The family Heteroderidae is represented by only four genera. Viz., Heterodera Schmidt, 1871, Meloidogyne Goeldi, 1887, Meloidodera Chitwood, Hannon and Esser, 1956 and Hypsoperine Sledge and Golden, 1964. All the four genera are endoparasitic. Meloidogyne, Meloidodera and Hypsoperine are gall formers and do not produce cysts, whereas Heterodera produces resistant cysts.

Meloidogyne is ubiquitous, and attacks wide variety of crops. Heterodera was supposed to be confined to temprate regions of the world but recent studies have shown that it is not true. Jones(1960) exploded this belief when he reported Heterodera rostochiensis Wollenweber, 1923 from, Madras; South India. Prasad, Mathur and Sehgal (1959) reported Heterodera avenae Wollenweber, 1924 (Filipjev, 1934) causing Molya disease of wheat and barley. Kumar (1964) reported H. cacti Filipjev and Schuurmans, and - Stekhoven, 1941 from Bangalore. Recently Swarup, Sethi and Gill (1964) have reported H. carotae Jones, 1950 and H. galeopsidis Goffart, 1936 (Skarbilovich, 1959) from potato and tomato fields of Simla and Delhi respectively. The author also found one new species of this genus parasitizing Cyprus rotundus L at Aligarh, India. This is the first new species described from Asia. The other two genera Meloidodera and Hypsoprine have not so far been reported from India.

DIAGNOSIS: Tylenchoidea: Adult females become swollen to form sub-spherical shape of the body. Spear well developed. Head skeleton also fairly well developed, at least in males. Median oesophageal bulb ovate. Oesophageal glands in lobes, overlapping the intestine. Ovaries paired. Vulva usually sub-terminal. Males vermiform, tails very short, bluntly rounded, without bursa one or two testes.

TYPE GENUS: Heterodera Schmidt, 1871
Syn. Heterobolbus Railliet, 1895
(Heterodera) Skarbilovich, 1959
(Globodera) Skarbilovich, 1959

KEY TO THE GENERA OF HETERODERIDAE

1- Females gall forming----------2
Females not gall forming----------3

2- Body cuticle of female abnormally thick; posterior portion of body slightly protruded into a cone-like structure------
----------Hypsoperine Sledge and Golden, 1964.
Body cuticle thin; posterior portion of body usually without a protuberance----------Meloidogyne Goeldi, 1887.

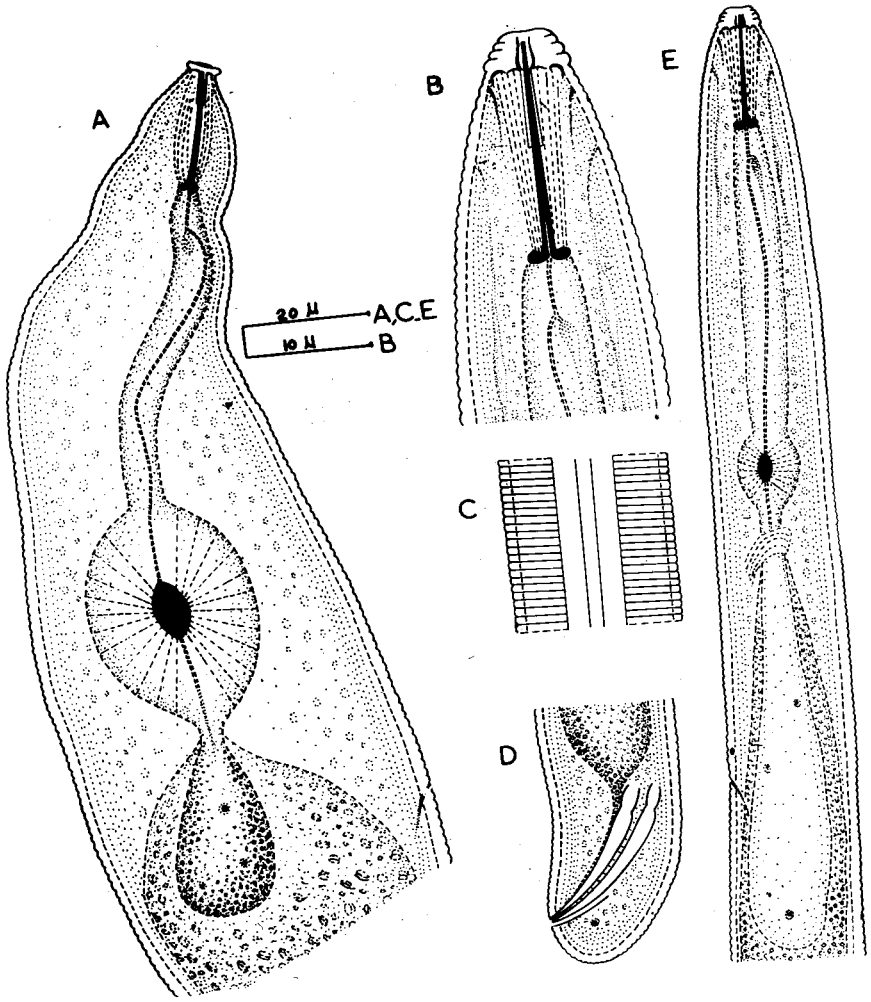
3- Female body becoming a brown cyst at maturity; vulva near terminus ----------Heterodera Schmidt, 1871.
Female body remaining white; vulva slightly posterior to middle of body----------Meloidodera Chitwood, Hannon and Esser, 1956.

Genus Heterodera Schmidt, 1871.

DIAGNOSIS: Heteroderidae: Adult females become swollen to form lemon-shaped, pear-shaped or round hard wall cysts

Plate No. 16.

Fig. A-E. *Heterodera mothi* n.sp. A- Neck region of female; B- Male head enlarged; C- Lateral field of male; D- Male tail; E- Neck region of female.


A
B
C
D
E
20 µ
A,C,E
10 µ
B

whose walls consist of thickened cuticle patterned in various ways with lace-like markings or punctuations and may be covered with whitish incrustations, the so called sub-crystalline layer. Eggs usually retained in the body but most species produce a gelatinous matrix, into which some species lay a few or more eggs. Head annulated, its lateral lips smaller than or equal in size to others. Amphid opening smaller slit than in Meloidogyne. A head cap appears to be absent. Head skeleton developed in male, apparently absent or little developed in females. Spear strongly developed with distinct basal knobs. Median bulb ovate; oesophageal glands in long lobes, overlapping intestine. Ovaries paired, vulva terminal, usually on a prominence. Anus sub-terminal. Body of male may be twisted through upto ½ turn (180°) in passing from head to tail. Tail very short, cloacal opening almost terminal. Incisures of lateral field go right round tail. Phasmids more or less adanal. No bursa. Spicules paired; gubernaculum present.

TYPE SPECIES: Heterodera schachtii Schmidt, 1871.

Heterodera mothi n.sp.

(Plate No. 16-18 Fig. A-C.)

FEMALES: (25) Plate No. 16 Fig. A.

MEASUREMENTS: (Specimens fixed in TAF and mounted in dehydrated glycerine).

LENGTH = 525 µ (460-590 µ); width 300 (110-350) µ;

Spear = 17-21 µ.

HOLOTYPE: length = 570 µ; width = 340 µ; spear = 18 µ.

DESCRIPTION: Body pearly white in appearance, lemon-shaped with protruding neck and vulva. Cuticle thick, 2.5-4.0 µ at mid-body, exhibiting zig-zag external pattern (Plate 1,C). Sub-crystalline layer present. Transverse annulation on neck and vulva and prominent. Head set-off from the body contour by cephalic constriction, bearing two annules; second annule larger than the first and generally somewhat disc-shaped. Cephalic sclerotization weak and indistinct. Stylet delicate with somewhat rounded knobs 17-21 µ long. Oesophageal gland opening 5.5-6.5 µ behind the base of the stylet. Valvulated median bulb large and distinct with strongly developed valve plates. Basal bulb extending as a long lobe of variable size and shape. Excretory pore opposite the basal bulb.

Ovaries two, convoluted, becoming indistinguishable due to the presence of eggs in the body. Vulva conspicuous, protruding posteriorly. Egg-sac absent. Anus distinct, at 16-18% of the cyst length from the end of vulvar region or 130-140 µ anterior to the vulva.

MALES: (15) Plate No. 16 Fig. B-E.

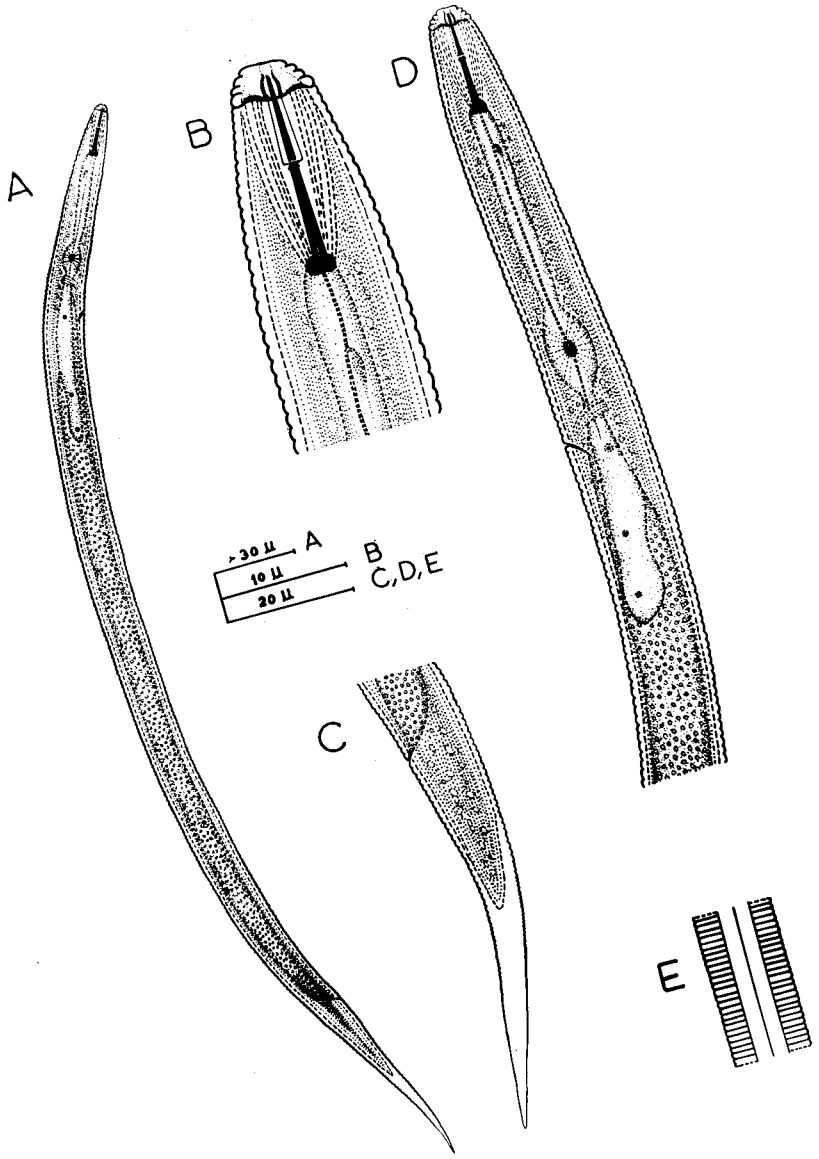
MEASUREMENTS: (Specimens fixed in TAF and mounted in dehydrated glycerine)

L = 8.83-1.2 mm; a = 35-46; b = 5.8-8.0; c = 148-330;

Spear = 19-23 µ; Spicules = 24-30 µ; Gubernaculum = 10-12 µ.

Plate No.18.

Fig. A-E. *Heterodera mothi* n.sp. A- Second stage larvae; B- Larval head enlarged; C- Lateral field; D- Oesophageal region of larva; E- Lateral field.


A
B
D
30 µ
10 µ
20 µ
A
B
C,D,E
C
E

DESCRIPTION: Males numerous; body cylindrical, elongate, usually dorsally curved. Cuticle distinctly annulated, annulation approximately 2 μ apart at mid-body. Lateral field marked by 4 incisures not crossed by transverse annulations; measuring approximately 1/3 of the body width. Head off-set from the body contour bearing 4-5 annules on the lip region with the first two anterior to the cephalic constriction more prominent than the others. Cephalic sclerotization heavy. Anterior cephalid usually on the second annule of the body, posterior cephalid on the eighth. Stylet well developed, 19-23 μ long with slightly anteriorly concave and antero-posteriorly flattened knobs. Dorsal oesophageal gland opening 4.0-4.5 μ behind the base of the stylet. Procorpus a slender tube ending in a distinct median bulb with well developed valve plates. Basal part of the oesophagus extending as a glandular lobe overlapping the anterior region of the intestine laterally; intestine packed with granules. Excretory pore 100-119 μ from the anterior end of the body. Hemizonid 4-5 annules anterior to the excretory pore.

Testis single, outstretched. Spicules paired, typical of the genus, 24-30 μ in length. Gubernaculum simple, 10-12 μ long. Tail dorsally convex conoid to bluntly rounded.

Second stage larvae: (50) Fig.3, A-E. **Plate No.18.**

Measurements: (Specimens fixed in TAF and mounted in pure glycerine).
L = 0.38-0.43 mm; a = 25-32; b = 2.7-3.4;
c = 5.5-6.5; spear = 16-17 μ.

A. M. KHAN & S. I. HUSAIN: *Heterodera mothi n. sp.*

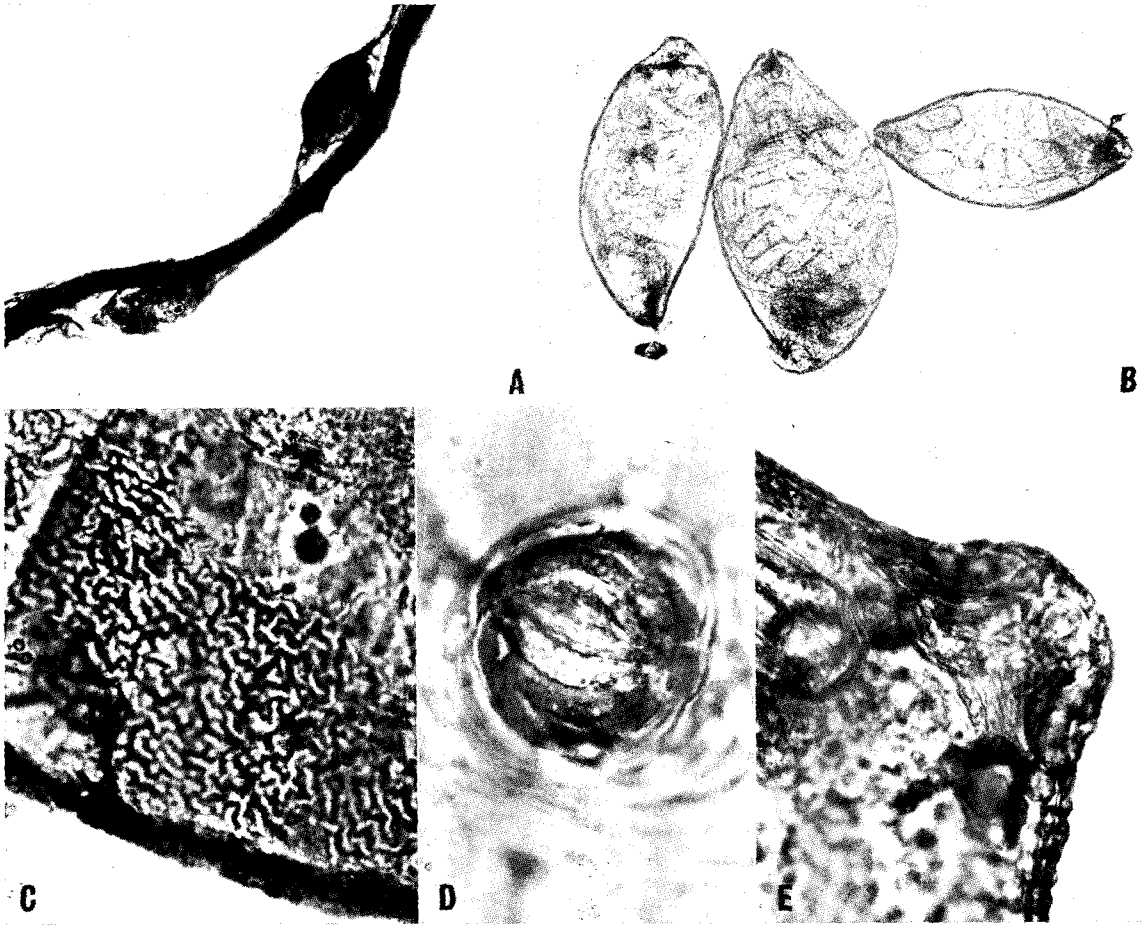


Fig. 1. *Heterodera mothi*. A — cysts on root of *Cyperus*; B — cysts; C — cuticular pattern of the cyst wall; D — cone top; E — lateral view of vulval cone.

DESCRIPTION: Body cylindrical, elongate, tapering at both ends. Head slightly off-set from the body contour bearing 4-5 annules in the lip region. Head cap averaging 3 x 7 µ. Transverse annulations distinct, 1.3 µ at mid-body. Lateral field approximately 2/5ths of the body width, consisting of 3 incisures but in some cases there appear to be 4. Cephalic framework heavily sclerotized. Stylet well developed with nearly rounded knobs. Dorsal oesophageal gland opening 5.0-6.5 µ behind the base of the stylet. Procorpus a slender tube ending in a distinct median bulb with prominent valve plates. Oesophageal glands extend as glandular lobe overlapping the intestine laterally with three prominent gland nuclei. Intestine packed with granules. Excretory pore situated behind the level of nerve ring, 70-85 µ from the anterior end of the body. Germinal cells distinct in the posterior region of the body, situated 135-155µ anterior to the tail tip. Anus usually obscure. Hyaline portion of the tail variable in length 30-40µ i.e. nearly twice the stylet length. Tail tapers to acute terminus Phasmids very small, located very far below the level of the anus, seen only in the most perfect lateral view, as illustrated in the diagram.

Cysts: (100) Plate II, A-B.

Measurements: (In water): Length = 0.63 (0.47-0.79) mm; width = 0.36 (0.23-0.48) mm.

Description: Cysts light to dark brown, lemon-shaped, with protruding neck, and vulva. External pattern on cyst cuticle

clearly zig-zag (Plate 17,C). Sub-crystalline layer present on young cysts. Egg-sac absent. Prominent dark-brown bullae present in the vulval cone region. Fenestra on the cone top is of the ambifenestrate type, approximately 36µ long by 27µ wide. Vulval-slit about 32µ: vulval bridge of equal length. Anus distinct, usually surrounded by a definite pattern. Punctuation on the inner layer of the cyst wall not distinct.

Egg: (150).

Measurements: (In water): length = 110 (100-123)u; width = 45 (40-47)µ; length/width ratio = 2.48

Egg shell hyaline, without visible markings.

DIAGNOSIS AND RELATIONSHIP: Heterodera mothi is characterised by 3 incisures in the lateral field of the second stage larvae; hyaline portion of the tail tip about twice the stylet length; phasmid quite far below the level of the anus in larvae; and size of the spear in females. H.mothi belongs to H.schachtii group because of its lemon-shaped cysts with bullae; zig-zag cuticular pattern and sheaf-shaped lining of the vagina. It differs from H.schachtii, H.glycines, H.trifolii and H.galeopsidis in the smaller average length of the second stage larvae; hyaline portion of the tail being about twice the stylet length against equal to stylet length in all the four above-mentioned species. It differs from H.oryzae in the body measurements of males; shape of the stylet knobs in males and larvae and shorter stylet of the larvae. It also differs from H.lespedezae Golden and Cobb, 1963,

in having a shorter female stylet, position of gland opening in females; presence of males and the lateral field in the larvae 2/5ths against 1/5th of the body-width.

HOLOTYPE: Female collected in May, 1963 from the roots of Cyperus rotundus L. Slide No. 601A, deposited with the Section of Plant Pathology, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male collected with the female, other data same as for holotype.

PARATYPES: Females, cysts, larvae and males deposited with Dr. M.T. Franklin, Rothamsted Experimental Station, Harpenden, Herts U.K.

TYPE HOST: Cyperus rotundus L.

TYPE LOCALITY: University Campus, Aligarh, U.P., India.

KEY TO THE SPECIES OF HETERODERA SCHMIDT, 1871.

(modified after Kirjanova, 1963)

1- Body of cyst avoid, round or globular i.e. with posterior portion rounded and vulva not located on a distinct protuberance----------rostochiensis group----------4

Body shape of cyst carrot-like (elongated), strongly enlarged on the head end and then gradually narrowing------ ----------methwoldensis Cooper, 1955.

Body of cyst lemon-shaped, i.e. with vulva located on a distinct protuberance----------2

2- Basic element of pattern of outer layer of cyst wall at middle portion of cyst short zig-zag lines with little or no trace of regular transverse arrangement, sometimes modified to appear as net-work----------3

Basic element of pattern of outer layer of cyst wall at mid portion of cyst straight or wavy lines, at right angles to axis of cyst; sometimes broken by short oblique or vertical lines; outer layer of cyst may have grainy appearance----------cacti group----------9

3- Mature cysts with dark bodies (Brown knobs) and sheaf-shaped object (lining of vagina) at posterior end. On immature cysts these seldom visible and then do not appear dark----------group bullata; Shachtii gp.....10

Mature cysts without brown knobs or sheaf-shaped object at posterior end---------group abullata; goettingiana gp.---25

4- Cuticle with punctuations----------5

Cuticle without punctuations----------6

5- Body shape oval (bean-shaped), hyaline tail portion significantly longer than the spear; the walls of cyst thin, the length of the eggs more than 2.5 times the width---
----------punctata Thorne, 1928.

Body round. Cuticular annules composed of interrupted zig-zag bulges----------pseudorostochiensis Kiranova, 1963.

6- Larvae very slender, a= 39; Orifice of the dorsal oesophageal gland about 2/3 spear length posterior to spear base----------leptonepia Cobb & Taylor, 1953.

Larvae not very slender, a = 22; orifice of the dorsal oesophageal gland at about ¼ spear length posterior to spear base----------7

7- Vulval-slit longer than 12 μ; probably a parasite of grasses, as it was found in soil in which grass had been growing for a long time. Hyaline portion of tail equal to length of the spear. (Bifenestral species, fenestra in the shape of large number 8)-----bifenestra Cooper,1955.

Vulval-slit shorter than 12 μ----------8

8- Distance between vulva and anus about 1-1½ times diameter of vulva----------rostochiensis Woellenweber,1923.

Distance between vulva and anus about 2-2½ times diameter of vulva----------tabacum Lownsbery & Lownsbery,1954.

9- Hyaline portion of larval tail about as long as spear; spear knobs concave anteriorly-----weissi Steiner,1949.

Hyaline portion of larval tail usually shorter than the spear; spear knobs cnnvex-----cacti Filipjev & Shuurmans Stekhoven,1941.

10- Cyst always with punctation consisting of dots of uniform size but not in rows; hyaline portion of larval tail at least 1-1½ times longer than the spear----------11

Cyst with or without punctation, mostly in rows if present; brown knobs not closely clusterred around vulva. Hyaline portion of the tail about as long as spear----------12

11- Cyst wall thick with strong pigmentation, fenestra in the shape of a small number 8. Bullae thick, numerous clustered around vulva---avenae Woellenweber,1924 (Filipjev, 1934).

Cyst wall thin with light pigmentation. Bullae slender and diffuse----------avenae var. arenaria Cooper,1955

12- Two under-bridges---------oxiana Kiranova, 1962.

Single under-bridge----------13

13- Body sharply narrowing from the base of the vulval-cone so that the cone looks like a small separate appendage--------

----------rumicis Pogosan, 1961.

Body not sharply narrowing to the base of vulval-cone, in such a manner that the vulval-cone looks like an elongation of body----------14

14- Cyst with obtuse cone and short vagina----------15

Cone sharp with long, sheaf-like vagina; vulval-bridge less heavily cutinized----------17

15- Vulval-bridge weakly chitinized, rather narrow. Basin as a narrow surface. Fenestra almost rounded, width of fenestra significantly greater than the length (height). Female cuticle very thick (12-14 μ)----------

----------paratrifolii Kiranova, 1963.

Vulval-bridge heavily chitinized, rather wide. Basin wide. Fenestra elongated. Female cuticle not as thick (less than 10 μ)----------16

16- Vulval-cone rather narrow. Mature female changes from yellow to brown just prior to dying. Under-bridge brown, held to the cyst wall by four rather thick arms of under-bridge----------galeopsidis Goffart, 1936.

Cone rather wide. Mature female light brown in colour. Under-bridge transparent, held to cyst wall by arms composed of thin fibres. Cuticular folds on the cone rather small, without punctations on the edges of annules. Hyaline tail tip longer than the spear. On the roots of Scleranthus annuus L. ----------

----------scleranthi Kakuna, 1957.

17- Fenestral length more than 60 µ. Eggs elongated (ratio of length to width more than 2.8). On Limonium vulgare Mill----------limoni Cooper, 1955.

Fenestral length less than 60 µ. Eggs shorter (ratio of length to width less than 2.8)----------18

18- Average length of larvae more than 500 µ----------19

Average length of larvae less than 484 µ----------20

19- Hyaline portion of the larval tail 1½ times the spear length. Cyst with distinct cuticular markings, punctuations and extensive sub-crystalline layer. Well developed tubus present in males---leuceilyma Di Edwardo & Perry, 1964.

Hyaline portion of the tail equal to spear length. Tubus absent in males----------trifolii Goffart, 1932(Goffart,1944)

20- Hyaline portion of the tail equal to the spear length----
----21

Hyaline portion of the larval tail 1½ times or more the spear length----23

21- Fenestra large and oval; colour of mature females varies from yellow to brown----22

Fenestra small rounded or slightly elongated; cuticular striations in the region of cone very thick, with punctation on the outer layer. Parasite of beet----
----schachtii Schmidt, 1871.

22- Hyaline portion of the larval tail not more than 1½ times the spear length----24

Hyaline portion of the larval tail twice or slightly more the spear length----23

23- Female spear 17-21µ long; dorsal oesophageal gland opening in female 5.5-6.5 µ behind the spear base; larval spear 16-17µ; egg sac absent----mothi n.sp.

Female spear 28-30µ long; dorsal oesophageal gland opening in female 4-5 µ behind the spear base; larval spear 19.5-22 µ----oryzae Luc and Brizuela, 1961.

24- Dorsal oesophageal gland opening in larvae 3.0-5.2µ behind the spear base. Eggs rather short (ratio of length to width less than 2.9)----25

Dorsal oesophageal gland opening in larvae 5-8 μ behind the spear base. Eggs rather longer (ratio of length to width 2.9)----------sacchari Luc and Merny,1963.

25- Males absent; larval spear 24.0-26.3 μ long; hyaline portion of the tail 23.5-38.8 μ----------
----------lespedezae Golden and Cobb,1963.

Males present; larval spear 23 μ; hyaline portion of the tail 26.6 μ----------glycines Ichinohe, 1952.

26- 3 incisures in the lateral field of larvae. Highly conspicuous anal area present, usually with definite pattern around anus of mature females and specially cysts. External pattern on cyst in middle portion generally indistinct-------cyperi Golden, Rau & Cobb,1962.

Nothing like above----------27

27- Fenestra twice as long as wide and divided by strong vulval-bridge, width of the vulval-bridge less than the width of the semi-fenestra. Semifenestra occasionally almost round----------Bifenestral group---------28

Fenestra 1-1½ times as long as wide; total width of fenestra perpendicular to vulval-slit, often less than the width of fenestra parallel to vulval-slit; vulval-bridge slender; underbridge short----------
----------ambifenestral or partially circumfenestral gp.

28- Vulval-cone short and wide. Cysts turn brown when the fenestra is nearly fully formed. Cuticular annulations form zig-zag structures on the vulval area as well as on other parts of the body. Underbridge strongly developed located so close to the vulval-bridge that it is difficult to differenciate---------*fici* Kirjanova,1954.

Vulval-cone longer and narrower. Cysts lighter when the fenestra is nearly fully formed. Underbridge located deeper, more transparent----------29

29- Underbridge very long. On the average cysts are larger----------*humuli* Filipjev, 1934.

Underbridge short. Cysts very small. Egg sac absent or very small- On *Urtica dioca* L----------*urticae* Cooper,1965.

30- Eggs rather short (ratio of length to width less than 2)----------31

Eggs rather long (ratio of length to width more than 2)----------32

31- Cone-top looks like brick-work; egg sac very small or absent. On pea bean and lentil----------*goettingiana* Liebscher, 1892.

Cone-top does not look-like brick-work; egg sac almost the same size as the cyst, often with 100-200 eggs. On the roots of *Polygonum*, *Chenopodium*, *Stellaria*, *Rumex* and other weeds----------*polygoni* Cooper,1955.

32- Length of larvae 390-430 µ; on cabbage and other cruciferous plants. Vulval-bridge well developed and rather thick----------*cruciferae* Franklin, 1945.

Length of larvae 430-475 µ; Only on carrot. Vulval-bridge very thin and semifenestra weakly differenciated---------- *carotae* Jones, 1950.

Heterodera estonica Kiryanova and Krall, 1963 could not be included in the key due to unavailability of literature.

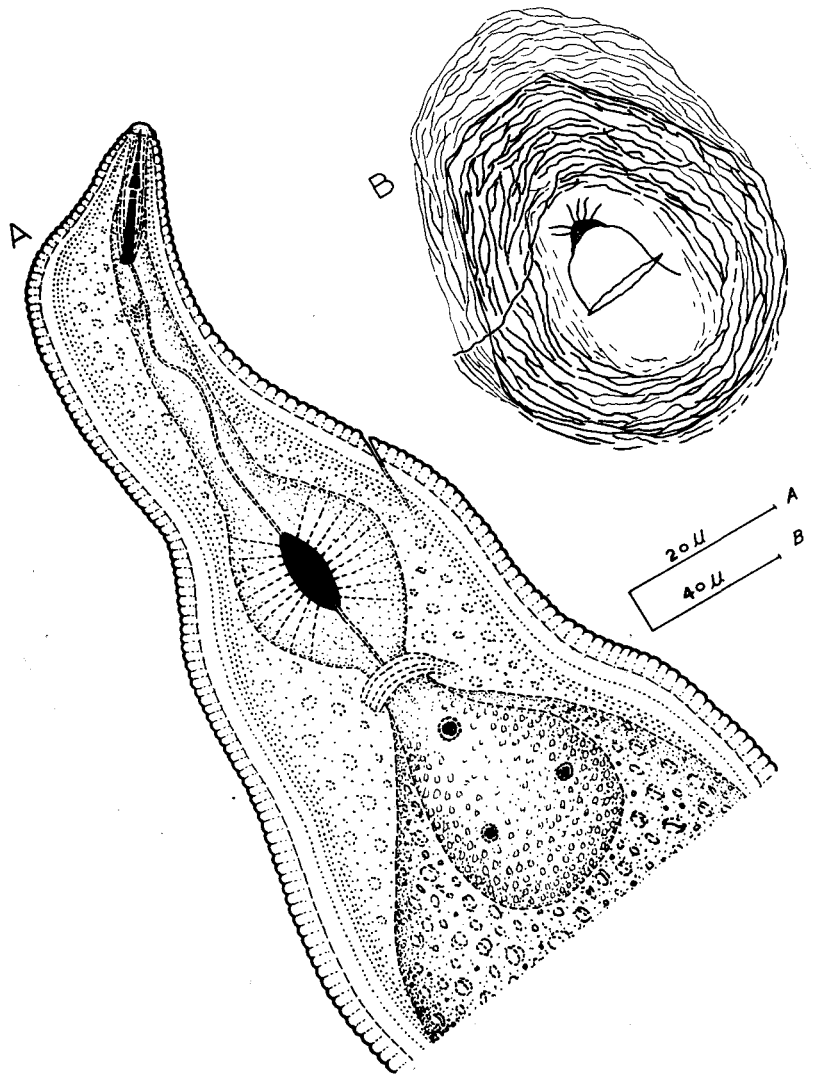
Genus *Meloidogyne* Goeldi, 1887

Syn. *Caconema* Cobb, 1924.

DIAGNOSIS: Heteroderidae: Adult females swollen, saccotae, body remains soft-walled. Lateral lips larger than others; amphid openings slit-like, larger than in *Heterodera*; a cap-like structure on the head. Excretory pore opening anteriorly to median bulb. Vulva terminal or nearly so; cuticle forming a 'finger print' pattern in perineal region; eggs not retained in the body but laid as an egg mass within gelatinous matrix. Males vermiform, lip region with or without distinct annulations, with head cap. Head skeleton well developed. Lateral lips larger than others, each about equal in size to the dorsal or ventral pairs; amphidx openings similarly large, slit-like and leading to broad pouches when viewed laterally (so called lateral cheeks). Spear well developed with rounded basal knobs. Tail very short, without bursa; spicules and gubernaculum present.

Plate No. 19.

Fig. A-B. *Meloidogyne goldeni* n.sp. A- Head end of female;
B- Perinneal pattern.


A
B
20 μ
A
40 μ
B

One testis (when two are present the male has been derived from a larvae which changed sex during development; Triaŧaphyllon,1960) Lateral field with incisures passing round the tail tip. Body twists through upto 180° or more passing from head to tail.

TYPE SPECIES: Meloidogyne exigua Goeldi, 1887.

Meloidogyne goldeni* n.sp.

(Plate No. 19-20; Fig. A-B-&A-E).

MEASUREMENTS OF FEMALES: (25) L = 0.4-0.65 mm; Width = 0.15-0.38 mm; Spear = 15-17 microns; average = 0.48 x 0.23 mm.

DESCRIPTION: Female a white saccate flask-shaped body with thin cuticle. Anterior region conical, posterior end broad. Body annulated. Head truncated, not set-off from the body contour, bearing three annules and a labial disc. Spear 15-17 microns long with weakly developed knobs. Gland opening 4-5 microns apart from the base of the stylet. Median bulb well developed, spherical, occupying nearly half of the width of the neck region. Excretory pore just infront of the median bulb.

Posterior cuticular pattern of the female very characteristic. The arch oval and high; dorsal arch slightly compressed. Ventral

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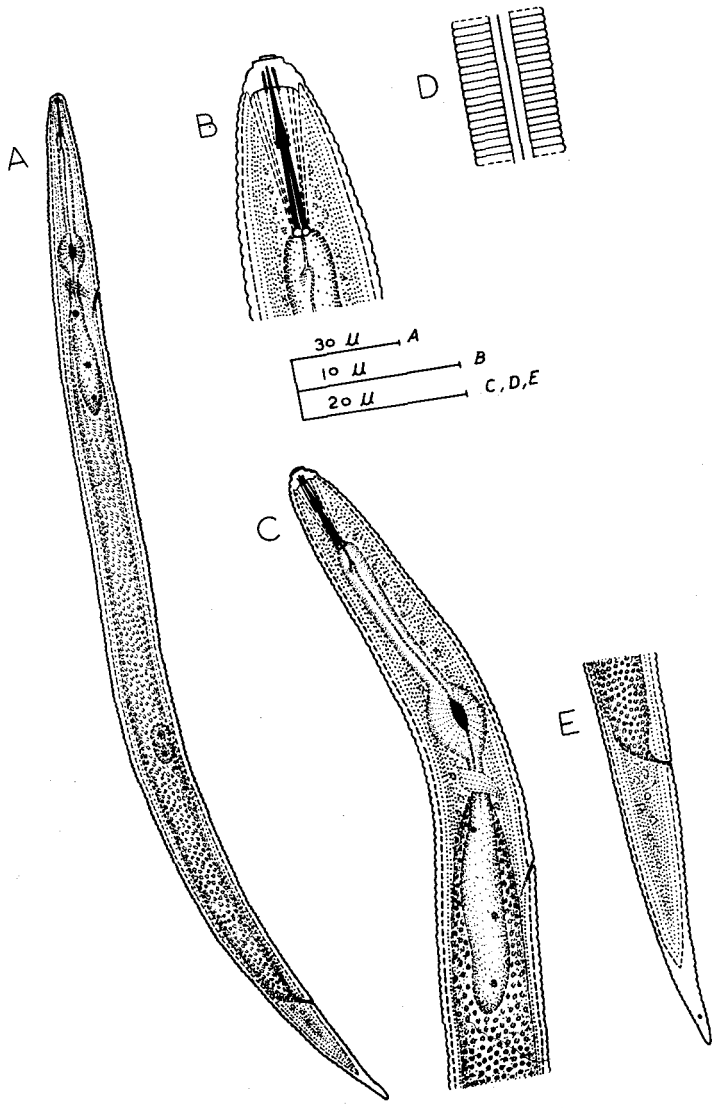
* Named after Dr. A.M. Golden, Nematologist, Nematology Investigation, Plant Industry Station, Beltsville, Maryland,USA.

Plate No. 20.

Fig. A-E. *Meloidogyne goldeni* n.sp. A- Second stage larva; B- Larval head enlarged; C- Head end of larva; D- Lateral field of larva; E- Larval tail.


A
B
D
30 μ
A
10 μ
B
20 μ
C, D, E
C
E

striae smooth, invariably unbroken. Dorsal striae closely spaced, wavy to zig-zag. Presence of striae arising from just below the vulva and joining the vulva and anus to form a tomb-like structure. A few striae also arise from the anus and projecting towards the tail tip. Single distinct lateral line only on one side of the arch. Vulval-slit measuring 25-28 microns; Anus 16-18 microns apart from the vulva.

MEASUREMENTS OF LARVAE: (25) L = 0.28-0.32 mm; a = 19-22; b = 4.0-5.5; c = 7.0-7.7; spear = 9.0-11.0 microns.

DESCRIPTION: Body elongate, cylindrical and annulated. Lateral field marked by three distinct incisures. Head not set-off from the body contour, two annules and a cap-like structure. Stylet delicate with feebly developed basal knobs, nearly 9.0-11.0 microns long. Gland opening 2.0-3.0 microns behind the base of the stylet. Corpus a slender tube. Median oesophageal bulb prominent, ovate with strong crescentic valves. Isthmus short encircled by a nerve ring. Excretory pore situated at 55.0-62.0 microns apart from the anterior end of the body. Basal portion of oesophagus glandular, overlapping the intestine. Intestine packed with dense granules. Tail elongate, cylindrical, tapering to a rounded terminus. Approximately 8.0-10.0 microns long portion of the tail is hyaline. Phasmids very small, difficult to locate, probably close to tail tip.

MALES: Not found.

HOLOTYPE: Female collected in November, 1963, slide No. 572 deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

PARATYPES: Females with their perineal pattern and larvae deposited with Dr. A.M. Golden, Nematologist, Nematology Investigations, Plant Industry Station, Beltsville, Maryland, U.S.A

TYPE HOST: Chrysanthemum carinatum L.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Meloidogyne goldeni comes closer to M.javanica (Treub, 1885), Chitwood, 1949 due to the presence of distinct lateral line but differs from it in the following characters:-

(i) Single lateral line on the right side of the arch instead of two on each side;

(ii) Presence of tomb-like structure resulting from striae developing from just below the vulva upto anus;

(iii) Presence of striae arising from the anus and projecting towards the tail tip;

(iv) Smaller female;

(v) Difference in body measurements of second stage larvae, the lateral field of which is characterised by three incisures;

(vi) Presence of rounded and blunt tail terminus with hyaline portion of tail 8-10 microns long.

KEY TO THE SPECIES OF MELOIDOGYNE, GOELDI, 1887

(modified after Kiranova, 1963)

1- Vulva, anus and rudimentary tail of females or just the rudimentary tail located on a projection of the posterior body end----------2

Vulva, anus and rudimentary tail of females on the rounded posterior body and body end not having any projection. Females usually inside galls. Perinneal pattern distinct---3

2- Only rudimentary tail and phasmids on the obtuse projection. Vulva and anus not situated on the obtuse projection but at some distance from the tail end. Lateral fields very distinct----------poghossianae (Pogosan, 1961) Kiranova, 1964

Cuticular pattern in the female on a slight prominence on the spherical body. The pattern has a distinct fold over the anus, large phasmids below the surface, a little closer together than dorsal arch----------

----------nassi Franklin, 1965.

3- Lateral field usually a distinct gap in the striae----------4

Lateral field usually obscure, but marked by irregularities of striae; a few striae broken----------6

No lateral field or punctations at tail tip, striae smooth, forming oval pattern with low, rounded arch----------

----------ovalis Riffle, 1963.

4- Lateral field bordered by one or two more or less continuous longitudinal incisures----------5

Lateral field a broad band, generally free from markings, strongly marked striae curve into each end of vulva giving a 'cheek-like' appearance----------Kikuyensis De Gr 196

Lateral field faintly marked with numerous small, short, rod-like striae, phasmids closer together than vulval lengths, tail tip plain but encircled by one or two striae----------africana Whitehea 1959.

5- Lateral field bordered by two more or less continuous longitudinal incisures traceable some way beyond perineal pattern; distinct whorl often present at tail tip---------

----------javanica (Treub,1885) Chitwood,1949.

Lateral field marked by one more or less continuous, parallel incisure only on side of the arch, some striae arise from below the vulva going upto the anus and forms a tomb-like appearance; some striae also arise from the anus and project towards the tail tip----goldeni n.sp.

6- Arch low, rounded or flattened from the dorsal side--------7

Arch high. Perineal pattern appears as regular or irregular oval----------10

7- Arch more or less rounded----------8

Arch flattened----------9

8- Often with cuticular punctations near tail tip, without small, irregular lines in the lateral fields----------haplа Chitwood,1949.

Without punctations at the tail tip, with small, irregular lines in the lateral fields----------arenaria (Neal,1889) Chitwood, 1949.

9- Perineal lines form lips near lateral fields----------exigua Goeldi,1887.

Lateral fields bordered by numerous short lines near the tail tip-----thamesi Chitwood in Chitwood, Specht and Havis, 1952.

Striae curving towards anus on each side to form an hour-glass-shaped pattern; striae often coarse; distance from anus to vulva about three times anus to interphasmidial line----------artiella Franklin,1961.

10- Striae smooth, both dorsal and ventral arches flattened giving pattern an oblong shape, tail tip area with slight irregularities; phasmids and anus almost in straight line----------brevicauda Loos,1953.

Striae wavy to zig-zag; Lateral field obscure; Striae, when broken at this point, often bifurcate----------11

11- Male head with 3 post-labial annules; dorsal oesophageal gland opening located posterior to head end at a distance a little longer than a spear length----------incognita (Kofoid and White,1919) Chitwood,1949.

Male head with one large post-labial annule; dorsal oesophageal gland opening located posterior to head end at a distance equal to twice a spear length (second stage larvae with 4 or 6 lateral lines)----------

----------inornata Lordello 1956.

Superfamily Aphelenchoidea (Fuchs,1937) Thorne,1949

Some of the members of this superfamily are economically quite important such as Aphelenchoides ritzema-bosi (Schwartz,1911) Steiner,1932, A. besseyi christie, 1942, A. fragariae (Ritzema Bos 1890) Christie, 1932 and Rhadinaphelenchus cocophillus (Cobb,1919) Goodey, 1960. Taxonomically it embraces forms which are plant parasites, mycophages, predators, insect parasites and associates. Goodey (1960) has revised the superfamily Aphelenchoidea and has suggested five families namely Aphelenchidae (Fuchs, 1937) Steiner, 1949, Aphelenchoididae (Skarbilovich, 1947) Paramonov, 1953, Paraphelenchidae (T. Goodey, 1951) J.B. Goodey, 1960, Anomyctidae, Goodey, 1960 and Sphaerularidae (Lubbock, 1861) Skarbilovich, 1947.

DIAGNOSIS: Tylenchida: Dorsal oesophageal gland emptying into lumen of oesophagus within the median muscular bulb infront of the oreseentic valves.

KEY TO THE FAMILIES OF APHELENCHOIDEA (FUCHS,1937) THORNE, 1949.

1- Oesophageal glands forming long lobes----------2

Oesophageal glands contained in an abutting bulb----------Paraphelenchidae (T.Goodey,1951) J.B.Goodey, 1960.

2- Head with frontal disc----------Anomyotidae Goodey,1960.

Head without frontal disc----------3

3- Male tail bursate with ribs, slender gubernaculum present----------Aphelenchidae (Fuchs,1937)Steiner,194

Male tail not bursate, gubernaculum absent; Spicules rose-thorn-shaped or derived therefrom----------Aphelenchoididae (Skarbilovich,1947) Paramonov,1953.

Family Aphelenchoididae (Skarbilovich,1947) Paramonov,1953.

DIAGNOSIS: Aphelenchoidea: Oesophageal gland forming a lobe lying separate dorsally in the body and joining the alimentary canal behind the first bulb. Male tail without bursa, 1,2 or 3 pairs of sub-ventral caudal papillae and sometimes pairs of glandular sub-ventral papillae present. Spicules more or less thorn-shaped. No gubernaculum.

TYPE SUBFAMILY: Aphelenchoidinae Skarbilovich,1947.

KEY TO THE GENERA OF APHELENCHOIDIDAE (SKARBILOVICH,1947) PARAMONOV,1953.

1- Very slender nematodes. Labial arches strongly sclerotized. Vagina unusually curved. Male tail extended into sclerotized spade-like extension----------Rhadinaphelenchus Goodey,1960.

Nothing like above----------2

2- Tails of both sexes long and filiform----------3

Tails of both sexes short and conoid with or without terminal mucro----------4

3- Anterior part of the stylet jointed, gubernaculum present----------Paraseinura Tim,1961.

Anterior part of the stylet not jointed, gubernaculum absent----------Seinura Fuchs, 1931.

4- Insect parasites or associates----------7

Plant parasites or associates----------5

5- Head sclerotization massive; pharynx and spear guide also well sclerotized. Spear with prominent rounded knobs. Anterior part of oesophagus wide, spathulate narrowing to a thin cylinder before joining the median bulb----------Megadorus Goodey, 1960.

Head, pharynx and spear guide sclerotization weak, spear with or without knobs or basal thickenings. Anterior oesophageal part cylindrical----------6

6- Spicules rose-thorn-shaped; apophysis absent----------
----------Aphelenchoides Fischer,1894.
Spicules separate, ventrally curved with prominent rostrum and large apex continuing the line of shaft; apophysis present----------Cryptaphelenchoides Goodey,1960.

7- Male tail with a terminal bursal-flap----------8
Male tail without bursa----------9

8- Vulva at 85% or more; median bulb elongate-oval or rectangular; six lips similar, rounded----------
----------Parasitaphelenchus Fuchs,1930.
Vulva at less than 85%; median bulb rounded; individual lips stand somewhat apart from one another, lateral lips somewhat narrower than the others----------
----------Busaphelenchus Fuchs, 1937.

9- Single spicule (perhaps a completely fused pair)----------
----------Peraphelenchus Wachek, 1955.
Spicules paired----------10

10- Post-vulval sac absent---Cryptaphelenchus (Fuchs,1937) Skryabin et al., 1954.
Post vulval sac present----------11

11- Spear without knobs ----------12
Spear with basal knobs ----------13

12- Male tail short, conical to a rounded tip; spicules paired, short, ventrally curved shafts, prominent large rostrum and large apex continuing the line of the shafts----------
----------Entaphelenchus Wachek,1955.

Male tail more conical to a point with a similar terminal spike; spicules separate, narrow and curved, each with a triangular ventral flange, proximally knobbed, rostrum and apex not developed------Ruehmaphelenchus Goodey, 1963.

13- Vulva with a characteristic flap of cuticle----------
----------Laimaphelenchus Fuchs, 1937.

Vulva without a cuticular flap----------14

14- Head with six equal lips, each of which higher than wide; median bulb rounded, barrel-shaped----------
----------Tylaphelenchus Rühm,1956.

Head with lips, distinctly separate from one another, the laterals narrower and projecting slightly in front of the others; median bulb rectangular----------
----------Ektaphelenchus Fuchs,1937 (Skrjabin et al,1954)

Genus Aphelenchoides Fischer,1894.

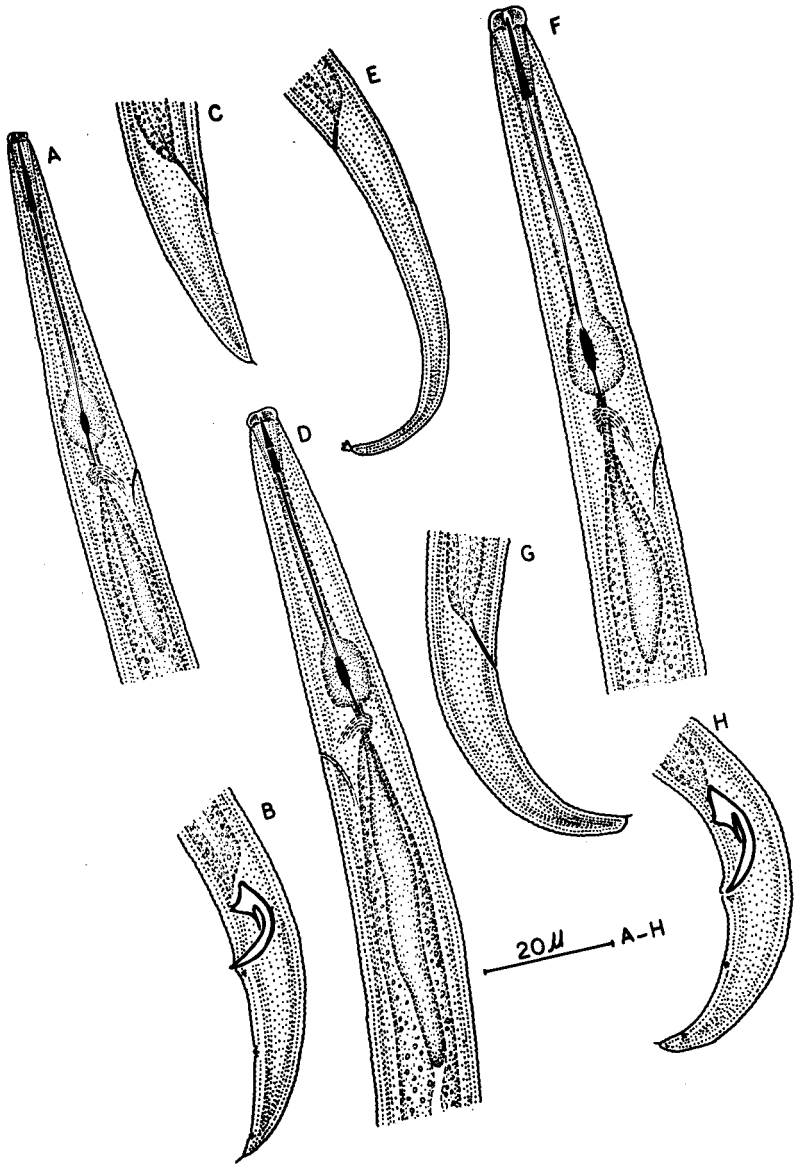
DIAGNOSIS: Aphelenchoididae: Body long and slender, often narrowed slightly beyond the vulva and again beyond the anus. Lateral field with incisures. Lip region offset, the six non-annulated similar lips supported by a hexaradiate star near the oral opening through which the spear passes. Spear with or without basal knobs. Procorpus of oesophagus cylindrical,

Plate No. 21.

Fig. A-C. Aphelenchoides absari n.sp. A- Oesophageal region of female; B- Male tail; C- Female tail.

Fig. D-E. Aphelenchoides andrassyi n.sp. D- Oesophageal region; E- Female tail.

Fig. F-H. Aphelenchoides chinensis n.sp. F- Oesophageal region of female; G- Female tail; H- Male tail.


A
B
C
D
E
F
G
H
20μ
A-H

joining the prominent first bulb which contains well developed crescentic valve plates; oesophageal glands forming a lobe lying free, dorsally in the body and joining the alimentary canal behind the first bulb. Ovary single prodelphic, outstretched with oocytes in one or more rows. Post-uterine sac present or absent. Male tail without bursa and gubernaculum with three pairs of ventro-submedian caudal papillae, the first pair approximately adanal, the others post-anal. Spicules rose-thorn-shaped. Tails of both sexes short, conical with or without mucron.

TYPE SPECIES: Aphelenchoides kuehnii Fischer,1894.

Aphelenchoides chinensis n.sp.

(Plate No.21 ; Fig.F.H.)

MEASUREMENTS OF EIGHT FEMALES: L = 0.375-0.55 mm; a = 25-30; b = 7.9-11.4 (measured upto median bulb); c = 14.1-19.0; v = 67.1-70.1%; Spear 12-15 μ;

MEASUREMENTS OF TWO MALES: L = 0.435-0.50 mm; a = 25.5-26.3; b = 7.9-8.9; c = 13.2-16.3; spear = 13-14 μ; Spicules = 19-22 μ.

DESCRIPTION: Body cylindrical, ventrally arcuate when relaxed by gentle heat, tapering on both extremities. Cuticle finely annulated. Lateral field marked by six incisures, outer ones being crenate, inner ones faint. Lip region distinclty setoff by a constriction. Spear 12-15 μ long without basal knobs. Procorpus a slender tube ending in a hemispherical median bulb,

valvular apparatus of the median bulb distinctly well developed. Isthmus short, encircled by a nerve ring just after the median bulb. Excretory pore nearly one median bulb-width behind the median bulb. Basal oesophagus in the form of long lobes overlapping the intestine dorsally. Rectum long, more than the anal-body width long. Tail convex-conoid, regularly tapering to a rounded terminus with a single ventral mucron, usually ventrally curved, slightly less than four times the anal-body width long.

Vulva post-equatorial. Ovary single, prodelphic, outstretched with oocytes arranged in a single row except for a short region of multiplication. Spermatheca not seen. Post-uterine sac long, nearly three times the vulvar-body width long.

Males similar to females in appearance. Testis single, outstretched. Spermatocytes serially arranged. Spicules paired, typically aphelenchoid in shape, sharply arcuate with a conspicuous ventral apex. Three pairs of post-anal subventral papillae present; One pair adanal, one pair midway along the tail, and a third pair near the tail terminus.

HOLOTYPE: Females, Slide No. 990, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Litchi chinensis.Sonner

TYPE LOCALITY: Dehradun, U.P., India.

DIAGNOSIS AND RELATIONSHIP:- Aphelenchoides chinensis comes closer to A.subtennis Cobb, 1926 but differs from it in the much smaller body size, position of vulva (V = 78% in A.subtennis), more slender and attenuated body and longer tail (c = 22-23 in A.subtennis).

Aphelenchoides absari* n.sp.

(Plate No. 21 ;Fig. A-C.)

MEASUREMENTS OF TEN FEMALES: L = 0.39-0.45 mm; a = 30-33; b = 4.0-4.5; c = 16.2-20.4; v = 69.2-77.3%; Spear = 11-13µ.

MEASUREMENTS OF TEN MALES: L = 0.32-0.43 mm; a = 30-35; b = 4.3-5.2; c = 11.5-16.8; spear @ 11-13 µ; Spicules = 15-19 µ

DESCRIPTION:- Body cylindrical, ventrally arcuate when relaxed by gentle heat, tapering on both extremities. Cuticle finely annulated. Lateral field marked by four incisures. Lip region distinctly set-off by a constriction, cap-like. Spear without basal knobs, measuring 11-13 µ in length. Procorpus a slender tube ending in an oval valvulated, median bulb. Isthmus short, encircled by a nerve ring, just below the median bulb. Excretory pore at the level of nerve ring. Hemizonid not seen. Basal oesophagus glandular, overlapping the intestine ventro-laterally. Intestinal region granular. Rectum short. Anus distinct. Tail convex-conoid with an obscure mucron; three times

* Named after Mr. Absar Mustafa Khan who provided the soil samples infested with this nematode species.

the anal-body width long. Tail mucron is distinct in males, nearly 3-4 μ in length.

Vulva post-equatorial. Ovary single, prodelphic, outstretched with oocytes arranged in a single file except for a short region of multiplication. Post-uterine sac absent.

Males similar to females in appearance. Testis single, outstretched. Spermatocytes serially arranged. Spicules paired, typically aphelenchoid type, 15-19 μ in length. 3 pairs of post anal subventral papillae present. One pair adanal, one pair midway along the tail and the third pair near the tail terminus. Tail as in females but with distinctly longer mucron.

HOLOTYPE: Female, Slide No. 991, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Saccharum officinarum L.

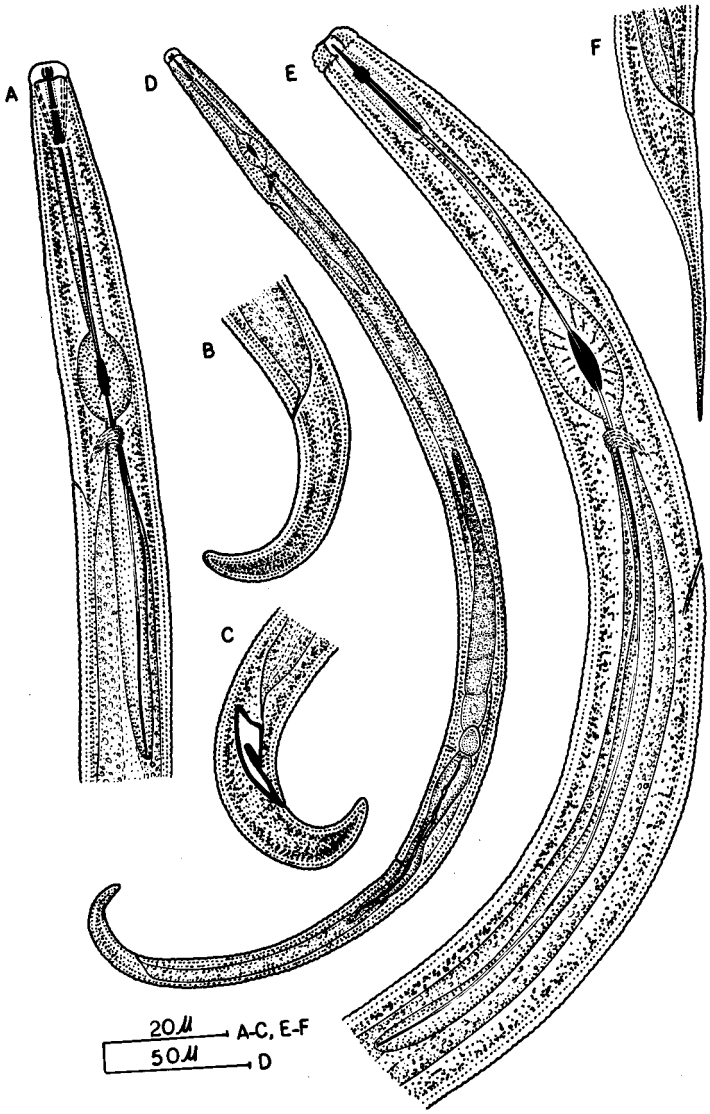
TYPE LOCALITY: Bulandshaher, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Aphelenchoides absari n.sp. comes closer to A.singhi Das, 1960, A.brevionchus Das, 1960, A.brevicaudatus Das, 1960 and A.parietinus Bastian, 1865. It differs from the first three in possessing unknobbed spear; and further from A.brevicaudatus and A.brevionchus in the size of spear and in the absence of females. It differs from A.parietinus

Plate No. 22.

Fig. A-D. *Aphelenchoides jacobi* n.sp. A- Oesophageal region of female; B- Female tail; C- Male tail; D- Female.

Fig. E-F. *Seinura oostenbrinki* n.sp. E- Oesophageal region; F- Female tail.


A
D
E
F
B
C
20 µ
A-C, E-F
50 µ
D

in the size of spicules in males and in the position of excretory pore which is situated at less than the median bulb width behind the median bulb (at 2 or more median bulb width behind the median bulb in A.parientinus).

Aphelenchoides jacobi* n.sp.

(Plate No.22 ;Fig.A-D.)

MEASUREMENTS OF FIVE FEMALES: L = 0.36-0.485 mm; a = 26.8-31.8; b = 3.4-4.7; c = 9.0-12.0; v = 65.1-70.8%; spear = 12-14 µ;

MEASUREMENTS OF TWO MALES: L = 0.35-0.41 mm; a = 27.3-31.8; b = 3.6-4.5; c = 11.4-15.2; spear = 13-14 µ; spicules =13-15 µ.

DESCRIPTION: Body cylindrical, curved when relaxed by gentle heat, tapering on both extremities, cuticle finely annulated. Lateral field marked by three incisures. Lip region setoff from the body contour by a distinct constriction, cap-like, family annulated. Spear without basal knobs, 13-14 µ in length. Procorpus a slender tube. Median bulb oval with well developed vulvular

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* Named after Mr. J.J. s'Jacob, ~~Plantenziekten~~ Landbouwhogeschool, kundige Dienst, Wageningen The Netherlands.

apparatus. Isthmus short encircled by a nerve ring. Excretory pore just below the level of nerve ring. Hemizonid not observed. Basal oesophagus forming a long lobe overlapping the anterior part of the intestine. Intestine packed with granules. Anus prominent. Rectum short, half the anal-body width long. Tail dorsally convex-conoid, ventrally curved with a rounded terminus lacking a mucron, nearly four anal-body width long.

Vulva post equatorial. Ovary single, prodelphic outstretched with oocytes arranged in a single file. Elongate pouch-like spermatheca present. Post-uterine sac 7/4 anal-body width long.

Males similar in appearance to females with shorter tail which is less than three anal-body width long. Testis single, outstretched. Spermatocytes serially arranged. Spicules paired, typically aphelenchoid type. Two pairs of post-anal sub ventral papillae present. One pair adanal and the second at mid tail length.

HOLOTYPE: Female, Slide No. 992, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male collected with females, other data same as for holotype.

TYPE HABITAT: Soil around the roots Hibiscus-rosa-sinensis L.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: In view of the tail shape Aphelenchoides s'jacobi n.sp. comes closer to A.abyssinicus Filipjev, 1931 and A.goeldi Steiner, 1914 but it differs from the former in much smaller body size and more posteriorly located vulva while from the latter in longer more slender body with longer tail and in more posteriorly located vulva (V =66% in A. goeldi).

Aphelenchoides andrassyi* n.sp.

(Plate No. 21 ;Fig. D-E.)

MEASUREMENTS OF THREE FEMALES: L = 0.39-0.435 mm; a = 23.0-27.6; b = 3.2-3.9; c = 6.4-11.8; v = 61.0-66.7%; spear = 9-10 µ.

DESCRIPTION:- Body cylindrical, ventrally arcuate on death, tapering on both extremities. Cuticle finely annulated. Lateral field marked by three incisures. Lip region distinctly set-off by a constriction. Spear short without basal knobs, 9-10 u long. Procorpus a slender tube. Median bulb oval with well developed vulvular apparatus. Isthmus short, encircled by nerve ring. Excretory pore and hemizonid not observed. Basal oesophagus glandular overlapping the anterior region of the intestine. Intestine packed with food granules. Anus distinct.

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* Named after Dr. I.Andrassy, Nematologist, Egyetemi Allatrendszertani Tanszek, Budapest, VIII. Puskin U.3.

Rectum half the vulvar-body width long. Tail long, elongate conoid, ventrally curved, regularly tapering to a rounded terminus provided with star-shaped mucro, nearly seven times the anal-body width long.

Vulva post equatorial. Ovary single, prodelphic, outstretched with oocytes arranged in a single file. Oval spermatheca present. Post-uterine sac long, nearly three times the vulvar-body width long.

Males not found.

Holotype: Female, Slide No. 993, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of Hibiscus rosa-Sinensis L.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: Aphelenchoides andrassyi n.sp. comes closer to A. asterocaudatus Das, 1960 and A. nonvielleri Andrassy, 1959. It differs from both of them in the smaller body size, unknobbed spear and in the position of vulva. It further differs from A. nonvielleri in the shape of tail mucro.

KEY TO THE SPECIES OF APHELENCHOIDES FISCHER,1894.
(Modified after Sanwal, 1961)

1- Female tail conoid, distinctly tapering to a sharp or rounded point, with or without mucronate structures at tail tip------11

2- Female tail not tapering to a sharp or rounded point but narrowing to an obtusely rounded or truncate terminus with or without mucronate or other kinds of structures at tail tip----------5

3- Female tail with a bifurcated tip----------8

4- Female tail elongate cylindrical, cylindroconical, finger shaped----------9

5-(a) Tail tip with three leaf like expansions----------Sphaerocephalus Goodey, 1953.

(b) Tail terminus bluntly rounded with a ventrally situated mucron----------6

(c) Tail short, bluntly rounded with a terminally situated filiform mucron----------martini Rühm, 1955.

(d) Tail tip obtusely rounded to truncate, without any mucronate structure----------limberi Steiner,1936.

(e) Tail truncate with two small horn-like projections----------Kungradensis Karimova, 1957.

(f) Tail truncate with a triangular chisel-shaped tip----------clarolineatus Baranovskaya,1958.

6- Female length 0.75 mm; a=39-42; c=22-23; V= 78%----------subtenuis (Cobb,1926) Steiner & Buhrer,1932.

Female length 0.369-0.55; V =67-75%----------7

7-(a) V = 67.1-70.1%; spear =12-15 µ; c = 14.1-19.0----------chinensis n.sp.

(b) V = 71-75%; spear = 10 µ; c = 19-26----------trivialis Franklin & Siddiqi, 1963.

8- (a) Female length 0.38-0.47 mm; a = 31.3-31.7; b = 6.8-8.4; c = 9.4-12.6 ----------

----*bicaudatus* (Imamura,1931) Filipjev & Schuurmans Stekhoven,1941.

(b) Female length 0.9-1.3 mm; a = 42.5-46.1; b = 11.2-13.4; c = 14-16.7--*hainanensis* (Rahm,1938) Goodey,T.,1951.

9- (a) Post-uterine sac absent; female tail elongate cylindrical, finger-shaped, 7.5 x anal-body width long---*abyssinicus* (Filipjev,1931) Filipjev,1934.

(b) Post-uterine sac present; female tail shorter than in *abyssinicus* cylindrical, finger-shaped----------10

10-(a) Tail not narrowing suddenly but narrows gradually to rounded terminus without a visible mucron at the tip; Post-uterine sac 1½ times the vulvar-body width long---

----------*jacobi* n.sp.

(b) Tail narrows suddenly and then gradually tapers to the tip bearing sharply pointed ventrally placed mucron; Post-uterine sac less than the vulvar-body width long---

----------*dactylocercus* Hooper,1958.

11- Female tail with or without a single, simple mucro at tail tip----------16

Female tail always with more than one mucronate structure or star-shaped structure at tail tip----------12

12- Female tail with four mucronate structures at tip----------13

Female tail with a distinct star-shaped structure at tip--14

13- Excretory pore anterior to nerve ring; post-uterine sac short, narrow, less than 4 times body width, four mucronate structures at tail tip (Sometimes divergent and may give the appearance of a star---------*besseyi* Christie,1942.

Excretory pore posterior to nerve ring, post-uterine sac five or more body widths long, four mucronate structures at tail tip---*ritzema-bosi* (Schwartz,1911) Steiner & Buhrer, 1932.

14-(a) Lateral field with two incisures---*asterocaudatus* Das,1960.

(b) Lateral field with three incisures----------15

(c) Lateral field with four incisures----------

---*Coffeae* (Zimmerman,1898) Filipjev, 1934

16-(a) Stylet simple without any basal thickenings, swellings or knobs----------17

(b) Stylet with distinct and clearly defined knobs----------28

(c) Stylet without distinctly formed knobs but with basal thickenings, basal swellings or faint knobs----------20

15- Body length 0.597 mm; c = 17; v = 72.6%----------

----------*nonvielleri* Andrassy, 1959.

Body length 0.39-0.435 mm; c = 6.4-11.8; v = 61-66.7%----

----------*andrassyi* n.sp.

17- Post-uterine sac absent----------18

Post-uterine sac present----------19

18- Head offset, cap-like; body length 0.39-0.45 mm;
V = 69.2-77.3% ----------absari n.sp.

Head not distinctly offset; body length 0.50-0.55 mm;
V = 75-80%------chamelocephalus (Steiner,1926) Filipjev,1934.

19- Female length 0.57 mm; V = 75%-----longiurus Das, 1960

Female length 0.58-0.69 mm; V = 63.5-68.0%----------
----------Subparietinus Sanwal,1961.

20- Post-uterine sac present----------21

Post-uterine sac absent, anterior end of body cylindrical,
not attenuated, head not setoff----------
----------goeldi (Steiner,1914) Filipjev,1934.

21- Post-uterine sac rudimentary, not more than 1½ times
vulvar-body width long (male tail with a sharp setoff
terminal spine)----------Spinosus Paesler,1957.

Post-uterine sac well developed, more than 1½ times
vulvar-body width long----------22

22- Lateral fields present----------23

Lateral fields absent, excretory pore behind level of
nerve ring------helophilus (De Man,1880) Goodey,T., 1933.

23- Lateral fields with four incisures at middle of body------24

Lateral fields with three incisures at middle of body-----27

24- Nerve ring almost immediately behind median oesophageal bulb----------25

Nerve ring about one body-width behind median oesophageal bulb----------26

25- Proportion between length and breadth of egg 2.6:1_____ Saprophilus Franklin,1957

Proportion between length and breadth of egg 4:1---------- ----------parientinus (Bastian,1865) Steiner, 1932.

26- Stylet thickenings slightly heavier than in parientinus; worms lie in the shape of a bow when relaxed by heat------ ----------cyrtus Paesler,1957.

27- Eggs 46 by 19 µ; c = 14 (11-17)---Composticola Franklin,1957.

Eggs 38 by 15 µ; c = 18 (13.8-24.7); tail rather wide as compared to composticola ------sacchari Hooper,1958.

28- Post-uterine sac present----------29

Post-uterine sac absent----------tagetae Steiner,1941.

29- Lip region distinctly demarcated from body----------3(

Lip region not demarcated from body, almost continuous with neck contour, lateral fields with two incisures------- --------fragariae (Ritzema Bos, 1890) Christie, 1932.

30- Stylet not more than 12 µ long----------3

Stylet more than 12 µ long----------

31- Excretory pore behind the level of median bulb----------32

Excretory pore at level of median bulb; stylet 8 μ long with thin, short-tip; tail wedge-shaped; associates of insects----------sinodendroni Rühm,1957.

32- Stylet 6.2 μ long; tail ending in a mucron formed by a sudden constriction of terminus----------

----------pusillus (Thorne,1929)

Filipjev, 1934.

Stylet 12 μ long; tail tip with a single, simple fine mucron----------singhi Das, 1960.

33- Tail gradually narrows to tip----------34

Tail narrows sharply on the ventral side after anus; stylet 15 μ long--------scalacaudatus Sudakova, 1958.

34- Stylet 14 μ long; tail without a mucron at tip----------

----------Kuehnii Fischer,1894.

Stylet 17 μ long; tail with a simple mucron at tip------

----------blastophthorus Franklin, 1952.

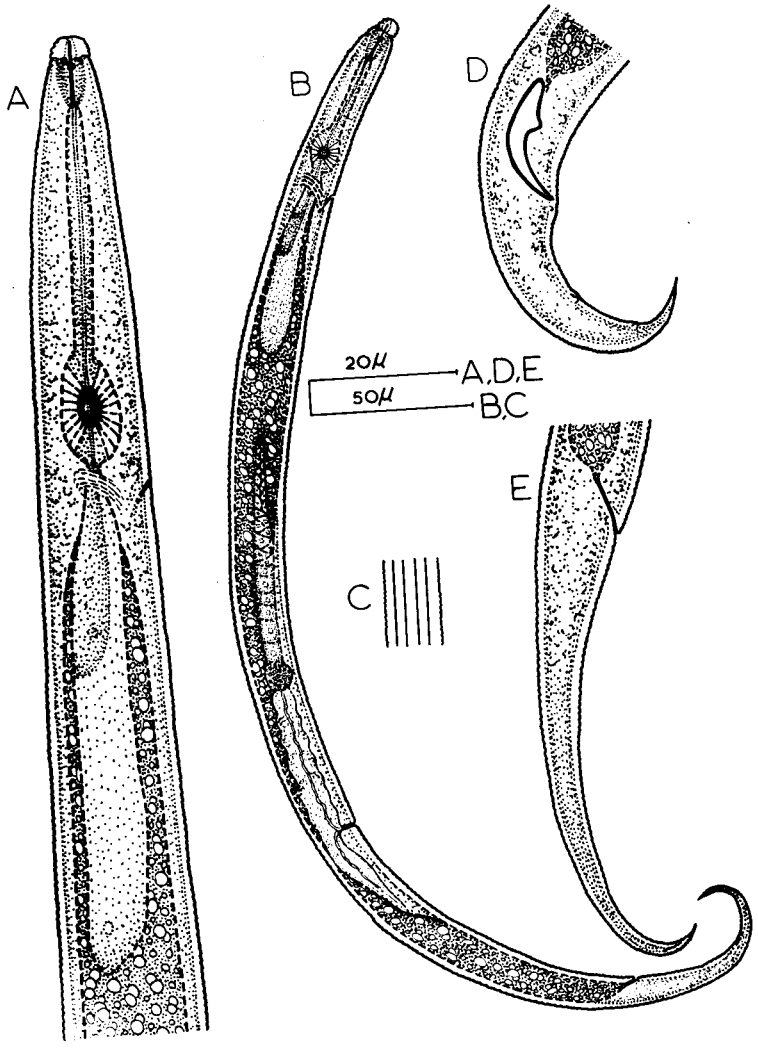
KEY TO THE SPECIES REPRESENTED BY MALES ONLY.

1- Median oesophageal bulb oval, tail short and bulky, about two anal-body width long, without a mucron----------

----------brevicaudatus Das, 1960.

Plate No. 23.

Fig. A-E. *Seinura nagini* n.sp. A- Oesophageal region of female; B- Female; C- Lateral field; D- Male tail; E- Female tail.


A
B
D
20μ
A,D,E
50μ
B,C
E
C

Median oesophageal bulb triangular in shape, tail not short and bulky as in brevicaudatus, about three anal-body width long, with a distinct, well developed-~~mucron~~------brevionchus Das, 1960.

Genus Seinura Fuchs, 1931.

DIAGNOSIS: Aphelenchoididae: Tail of both sexes elongate filiform. Spear long and slender ranging from 10-27 µ, usually without knobs, except in three species where small knobs are present Median bulb oblong or long oval with prominent valve plates. Spicule paired; the proximal end of the transverse bar prolonged with the dorsal limb into a prominent apex with a prominent rostrum at the other end of the transverse bar. Supplements present, one pair pre-anal, 2nd adanal and one or two pairs post-anal.

TYPE SPECIES: Seinura mali Fuchs, 1931.

Seinura nagini n.sp.
(Plate No.23; Fig.A-E)

MEASUREMENTS: 15 females:- L = 0.32-0.40 mm; a = 28-31; b = 3.0-4.0; c = 6.0-8.0; v = 60-64%; spear = 12-15 µ.
One male: L = 0.35 mm; a = 25.0; b = 3.5; c = 10.0; spear = 13 µ; spicules = 18 µ.

DESCRIPTION: Body cylindrical, ventrally curved on death, tapering on both extremities, finely annulated. Lateral field marked by four incisures. Lip- region with three to four annules, distinctly setoff by a constriction, without refractive oral armature, cap-like measuring 5 X 3 µ. Cephalic frame-work obscure. Spear 12-15 µ long with small but distinct basal knobs and broad lumen. Small spear guide present just above the middle of spear. Corpus a slender tube ending in a distinctly longer than wide median bulb with well developed valve plates. Excretory pore distinct at the level of nerve ring, situated 45-52 µ apart from the anterior end of the body. Hemizonid not observed. Oesophageal glands forming long lobes. Intestinal lumen broad and distinct, intestine packed with food granules. Anus distinct. Vulva

prominent, ovary single, prodelphic, outstretched. Oocytes arranged in two rows. Rounded spermatheca present. Post-uterine sac slightly more than the vulvar-body width long. Vulva anus distance more than tail length. Tail long and filiform with acute terminus, 6-7 times anal-body width long, terminal tail portion hooked, lacking a mucron.

Males similar to females in appearance. Testis single, outstretched. Spermatocytes serially arranged. Spicules 18 μ long, the proximal end of the transverse bar prolonged with the dorsal limb in a prominent apex and a prominent rostrum at the other end of the transverse bar. Supplements consisting of an adanal pair and two pairs post-anal papillae. Tail shorter than females, conoid ventrally curved, ending in a fine pointed flagellum-like terminus.

HOLOTYPE: Female collected in October 1964, Slide No. 1001 deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male collected with the females, other data same as for holotype.

PARATYPES: Two females, Slide No. 641 deposited with Nematology Investigation, Plant Industry Station, Beltsville, Maryland, U.S.A. and one female at Rothamsted Experimental Station, Harpenden, Herts, U.K.

TYPE HABITAT: Soil around the roots of Saccharum officinarum L.

TYPE LOCALITY: Nagina Agricultural Farm Nagina, District Bijnor, U.P., India.

DIAGNOSIS AND RELATIONSHI: Seinura nagini n.sp. differs from all the known species by having smaller body being smallest amongst the species so far described. In the position of vulva too it differs from all the known species except S. filicaudata (Christie, 1939) Goodey, 1960, but differs from it in body measurements and other characters.

Seinura oostenbrinki* n.sp.

(Fig. E-F.; Plate No. 22)

MEASUREMENTS OF FIFTEEN FEMALES: L = 0.51-0.70 mm;

a = 30.1-31.7; b = 8.0-10.0 (measured upto median bulb);

c = 8.6-12.0; v = 73.2-82.9%; spear = 19-22 µ.

DESCRIPTION:- Body cylindrical, slightly ventrally curved when relaxed by gentle heat, tapering on both extremities, finely annulated. Lip region with three to four annules, distinctly set-off by a constriction without refractive oral armature, cap-like, measuring 8x4 µ. Cephalic framework obscure. Spear 19-22 µ long without basal knobs but with distinct and broad lumen. Small spear guide present just above the middle of spear.

---

* Named in honour of Dr. M. Oostenbrink, Plantenziektenkundige, Dienst, Wageningen, The Netharlands. Reader in nematology at the Landbouwhoge

Corpus a slender tube ending in a twice as long as wide median bulb with well developed valve plates. Nerve ring crosses the isthmus just behind the median bulb. Oesophageal glands forming long lobes. Excretory pore 1¾ body with or 28-32 μ behind the median bulb. Hemizonid prominent, situated just anterior to the excretory pore. Intestinal lumen broad and distinct, intestine packed with food granules. Anus distinct. Rectum short. Tail long and attenuated, abruptly narrowing just after 1/4th of its length from the anterior end to filiform shape terminating into a finely pointed terminus, nearly five times the anal-body width long. Phasmid slightly preanal.

Vulva prominent. Vagina at right angles to the body axis, short, extending only 1/5 of the vulvar-body width. Ovary single, prodelphic, outstretched. Oocytes arranged in two rows. Spermatheca absent. Post-uterine sac 1/3 to slightly more than 1/2 vulvar body width long.

Males not found.

HOLOTYPE: Female, slide No. 642, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of *Allium cepa* L.

TYPE LOCALITY: Aligarh.

DIAGNOSIS AND RELATIONSHIP:- *Seinura oostenbrinki* n.sp. comes closer to *Seinura diversus* (Paesler,1957) Goodey,1960 but differs

from it in the smaller and more slender body, and in tail length less than vulva-anus distance (tail length 1½ times the vulva-anus distance in S.diversus).

KEY TO THE SPECIES OF SEINURA
(Modified after Christie,1939)

1- Length of tail in female at least twice as great as distance from vulva to anus----------longicaudata (Cobb,1893) Goodey,1960.
Length of tail in female not over one and half times as great as distance from vulva to anus----------2

2- Tail long, C = 4.0-4.2----------citri (Andrassy,1957) Goodey,19
Tail short, C = 4.5 or more ----------3

3- Stylet with small but distinct basal swellings or knobs--4
Stylet without basal swellings or knobs----------7

4- Post-uterine sac absent----------5
Post-uterine sac present----------6

5- C = 5.3-5.8; spear = 16-19 μ ----demni (T.Goodey,1928) J.B.Goode 19
C = 6.7-8.5; spear = 15-16 μ ----olivorae (Christie,1939) Goodey 1960.

6- Males known; Female length 0.3-0.40 mm ----------
----------nagini n.sp.
Males unknown; Female length 0.76-0.86 mm.....-
----------Oahuensis (Christie,1939) Goodey,1960.

7- Body of female with conspicuous and moderately coarse transverse striae forming distinct annules; males unknown----------linfordi (Christie,1939) Goodey,1960.

Body of female with inconspicuous transverse striae----------8

8- Post-uterine sac short or absent----------9

Post-uterine sac well developed, usually extending at least half way from vulva to anus----------1

9- Post-uterine sac absent----------1

Post-uterine sac present, not more than one vulvar-body width long----------1

10- Males unknown; Head offset by a constriction----------oxuris (Paesler, 1957) Goodey, 1960.

Males known; Head slightly offset----------winchesi (T. Goodey,1927) J.B.Goodey,1960.

11- Post-uterine sac one vulvar-body width long; L=0.46-0.61 mm----------paratenuicaudata Geraert, 1962.

Post-uterine sac less than 3/4 vulvar-body width long; L = 0.62-1.03 mm----------1

12- V = 61-66%----------filicaudatus (Christie,1939) Goodey,1960.

V = 75-82%----------1

13- Post-uterine sac longer than 3/4 vulvax anus distance----------mali Fuchs, 1931.

Post-uterine sac less than 2/3 vulvax anus distance----------1

14- Spear short, about 10 µ long; vulva at about 62%; c = about 4.5------elmiraensis (V.d. Linde,1938) Goodey,1960.

Spear 14 µ longer; vulva at 66% or more;c=7 or more----------1

15- Males unknown;c=12; lips faintly developed----------pswegoensis (V.d. Linde,1938) Goodey,1960.

Males known; c=7.7-11; lips well developed----------1

16- Spear = 16-19 µ; c = 9-10--------*christiei* Goodey,1960.

Spear = 22-27 µ; c = 7.7-8.7----------

----------*tenuicaudata* (De Man,1895) Goodey, 1960.

17- Average body size 0.76 mm; tail 1½ times vulva-anus distance; a =24-28-----*diversus* (Paesler,1957)Goodey,1960.

Average body size 0.6 mm; tail less than vulva-anus distance; a = 30-34.7------*oostenbrinki* n.sp.

Family *Paraphelenchidae* (T. Goodey,1951)
J.B. Goodey, 1960.
Syn. *Paraphelenchinae* T.Goodey,1951.

DIAGNOSIS: Aphelenchoidea; Oesophageal glands contained within the confines of the post bulbar region of oesophagus. Male tail without bursa, with 4 or 5 pairs of caudal papillae. Spicules long and narrow. Gubernaculum present.

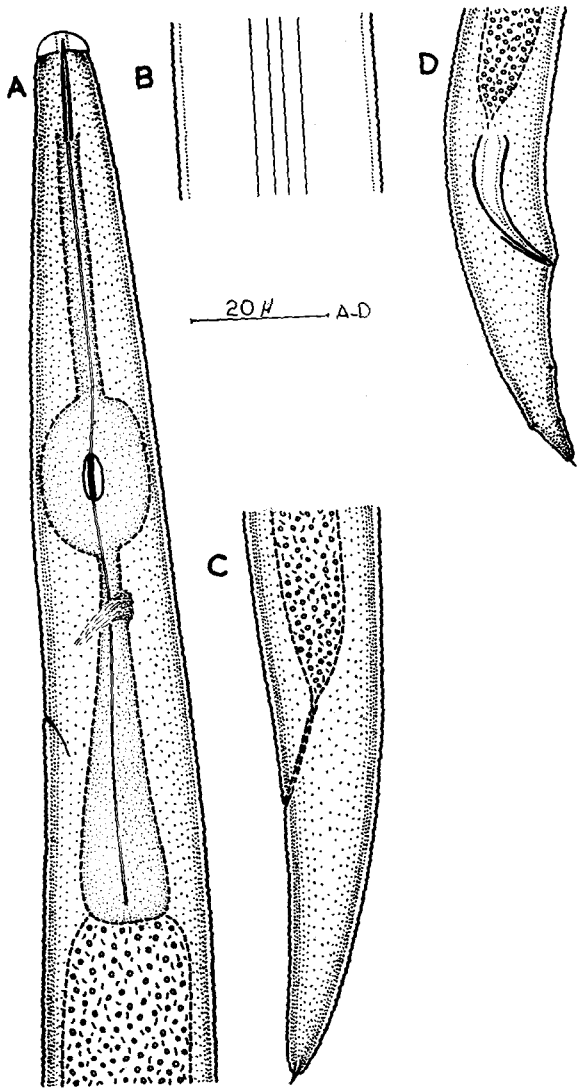
TYPE AND ONLY GENUS: *Paraphelenchus* (Micoletzky,1922)
Micoletzky, 1925.
Syn.*Aphelenchus* (*Paraphelenchus*)
Micoletzky, 1922.

Genus *Paraphelenchus* (Micoletzky, 1922) Micoletzky, 1925.

DIAGNOSIS: Paraphelenchidae: Head a flat cap, continuous or

Plate No. 24.

Fig. A-D. Paraphelenchus saccheri n.sp. A- Oesophageal region of female; B- Lateral field; C- Tail of female; D- Tail of male.


A
B
D
20 μ
A-D
C

offset, 6 lips equal but not annulated. Oesophageal glands contained within a spathulate second bulb which is joined to the first by a narrow isthmus. Excretory pore just behind the median bulb and joining by a fine duct, a uninucleate cell which lies ventral to the junction of oesophagus and intestine, and which pushes the junction somewhat dorsally, also joining a longitudinal duct that runs anteriorly and posteriorly in the right lateral chord. Vulva posterior. Ovary outstretched, prodelphic. Post-vulval sac present. Female tail short, conical, sometimes with terminal mucron. Male tail with characteristic pattern of caudal papillae: pair I (which may be absent or a single median papillae) preanal, pairs 2,3 and 4 sub-ventral, 2nd adanal, 3rd at mid tail length and 4th sub-terminal, 5th also sub-terminal but sub-dorsal. Spicules paired, slender. A linear gubernaculum present.

TYPE SPECIES: P.pseudoparietinus (Micol.,1922) Micol., 1925

Syn.Aphelenchus (Paraphelenchus) pseudoparietinus Micoletzky,1922.

Paraphelenchus sacchari n.sp.

(Plate No. 24 ;Fig. A-D.)

MEASUREMENTS OF FIVE FEMALES: L = 0.59-0.88 mm; a = 30.3-38.6; b = 5.1-6.6; c=19.5-21.1; v= 68-76.7%; spear = 11-16 µ.

MEASUREMENTS OF TWO MALES: L = 0.61-0.66 mm; a = 38.8-39.2; b = 5.1-5.2; c = 20.9-21.3; spear = 14 µ; Spicules = 25 µ; Gubernaculum = 10-11 µ.

DESCRIPTION: Body cylindrical, assuming ventrally arcuate shape when relaxed by gentle heat. Cuticle distinctly annulated, sub-cuticle finely annulated. Lateral field marked by four crenate incisures, occupying 1/5 of the body-width. Head flat, cap-like offset by a constriction, measuring 7 µ in width and 3 µ in height. Spear short, 11-16 µ long, without basal swellings Corpus a slender tube joining well developed ovoid median bulb with strongly developed crescentic valves. Basal bulb elongate-pyriform, obscure. Nerve ring crossing the isthmus above the level of excretory pore. Excretory pore 95-105 µ apart from the anterior end of the body. Intestine granular. Rectum distinct nearly one anal-body width long. Tail dorsally convex-conoid with a distinct mucron. Tail tip round. Phasmid 8 µ anterior to the level of anus.

Vulva a transverse slit. Ovary single, prodelphic, outstretch with oocytes arranged in a single file except for a short-region of multiplication. Post-uterine sac distinct nearly three times the vulvar-body width long, extending 1/3 to nearly half the vulva- anus distance.

Males similar to females in general shape and appearance.

Testis single, outstretched. Spermatocytes serially arranged. Spicules paired, separate, arcuate and cephalated, 25 μ long. Gubernaculum simple, 10-11 μ in length. Supplements as shown in fig.I.C.

HOLOTYPE: Female, Slide No. 972, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim Universit Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Saccharum officinarum

TYPE LOCALITY: Bulandshaher, U.P., India.

DIAGNOSIS AND RELATIONSHIP:- Paraphelenchus sacchari n.sp. comes closer to P.basili Das, 1960, but differs from it in the larger body size and shorter tail.

KEY TO THE SPECIES OF PARAPHELENCHUS (Micol.,1922) Micol., 1925.

1- Adult female with a terminal caudal mucro----------2

Adult female without a terminal caudal mucro----------

----------mycoliophthorus Goodey, 1958.

2- Tail mucro hooked, claw-like----------

----------amblyurus Steiner,1934.

Tail mucro not hooked----------3

3- Lateral field with four incisures----------4

Lateral field with 8-9 incisures----------

----------pseudoparietinus (Micol.,1922) Micol.,1925.

4- Body size 0.55-0.59 mm; c = 15.6-18.0----------

----------basili Das,1960.

Body size 0.59-0.88 mm; c = 19.5-21.1----------

----------sacchari n.sp.

Paraphelenchus tritici Baranovskaya, 1958 and P.batavicus Filipjev, 1934 could not be included in the key due to unavaildbility of literature.

PART -II.

THE ORDER DORYLAIMIDA (De Man,1876) Pearse,1942.

This order received very little attention because the parasitic nature of many genera was not known till recently. It is within the last decade or so, that parasitic nature of Xiphinema, Longidorus and Trichodorus species have been establishe Moreover some species of the above mentioned genera have been conclusively proved to be vectors of soil borne viruses such as Fan leaf virus of grapevines (Hewitt, Raski and Goheen,1958), Tobacco rattle virus (Walkinshaw, Griffin and Larson, 1961), Arabis mosaic virus (Harrison and Cadman, 1959), Tomato black ring virus (Harrison, Mowat and Taylor, 1961) and early browning virus of peas (Van Hoof, 1962) etc.

Since the publication of the classical monographs on Dorylaimoidea by Thorne and Swanger (1936) & Thorne (1939), numerous species belonging to different families and subfamilies have been described. As a result of it the taxonomy of this group has undergone considerable change. Recently Clark (1961) Jairajpuri (1963,64) and Thorne (1964) have given an extensive account of this order.

DIAGNOSIS: Nematodea: Cuticle smooth or sometimes striated, no setae present. Oesophagus cylindrical, in 1 or 2 parts; when 2, the hind part conoid, cylindrical or pyriform. Gland

uninucleate and contained within the confines of the oesophagus, 3,5 or 7 in numbers; all gland openings posterior to the nerve ring. Head with 6-18 inner labial and 6,10 or 14 outer labial papillae. Amphids cyathiform, pouch-like or tubular. Stoma with mural tooth or teeth; an axial spear or vestigial and unarmed. Pre-anal supplements usually present.

KEY TO THE SUBORDERS OF DORYLAIMIDA (De Man,1876) Pearse, 1942.

1- Spear axial or mural tooth; excretory pore absent; Testis paired; Pre-anal supplements paired or single--------
----------Dorylaimina (De Man,1876) Pearse, 1936.

Stoma unarmed, reduced or complex; excretory pore present; Testis single; Pre-anal supplements never paired----------
----------Alaimina (Micoletzky,1922)Clark,1961.

Suborder Dorylaimina (De Man,1876) Pearse,1936.

DIAGNOSIS: Dorylaimida: Amphids cyathiform or pouch-like. 5 or 3 oesophageal glands present. Oesophagus cylindroid (Mononchoidea) or slender anteriorly with an expanded posterior part, rarely bibulbar; nerve ring degenerate. Axial spear or mural tooth or teeth present; all of which are lost at the molt. Excretory pore absent. One or two ovaries. Males with two testes and an ejaculatory duct. Spicules paired, free and robust.

Gubernaculum and lateral guiding pieces present or absent. Pre-anal supplements paired in Dorylaimoidea or single in Mononchoidea. Pre-rectum usually distinguishable. Only Monochoides have caudal glands and a terminal duct.

KEY TO THE SUPERFAMILIES OF DORYLAMINA (De Man,1876) Pearse, 1936.

1- Oesophagus cylindroid; Stoma with wide chamber, Cuticularized with mural tooth or teeth----------Mononchoidea (Chitwood,1937) Clark,1961.

Oesophagus divisible into anterior slender and posterior bulbar part; Stoma narrow with axial spear or mural tooth----------2

2- Basal oesophageal bulb surrounded by strong muscle sheath----------Belondiroidea Thorne,1964.

Basal oesophageal bulb not surrounded by muscle sheath----------Dorylaimoidea (De Man,1876) Thorne,193

Superfamily Dorylaimoidea (De Man,1876)Thorne,1934.

DIAGNOSIS: Dorylaimina: Body length rarely more than 10 mm. Amphids stirrup-shaped or pouch-like with slit-like or pore-like apertures. Oesophagus consisting of a slender anterior part and

an expanded posterior occassionally with a chamber, or bibulbar. Stoma provided with an axial spear or mural tooth, the aperture of which is dorsally placed. Spear is shed in moulting and replaced by another which has formed in a cell in the left subventral wall of the anterior part of the oesophagus. Larval dorylaimus are often seen with one or more spare spears awaiting use by later stages of the nematode. Between the spear and the oesophagus is a connecting part, the spear extension. Anteriorly it is attached as a fixed ring to the surrounding stoma wall, medianly also to the stoma wall and posteriorly around the spear base at about its junction with the spear extension. There may be a forward evagination of this sheath giving the appearance of a wide or double ring surrounding the spear. This anterior end of the guiding sheath has been referred to as a guiding ring in its single or double state. Lateral pores and pre-rectum present, supplements in the male consisting of a ventral series and an adanal pair. Testes two. No setae, caudal glands or terminal duct. Excretory pore absent.

TYPE FAMILY: Dorylaimidae De Man, 1876.

KEY TO THE FAMILIES OF DORYLAMOIDEA (De Man,1876) Thorne,1934.

1- Walls of pharynx or vestibule or both cuticularized----------
----------Actinolaimidae (Thorne,1939) Meyl,1960.

Walls of pharynx or vestibule not sclerotized----------2

2- Spear present----------3

Spear absent, mural tooth present----------

----------Camphydoridae (Thorne,1935) Clark,1961.

3- Spear without aperture, solid, needle-like----------

----------Basirhotyleptidae Siddiqi and Khan 1965.

Spear with aperture----------4

4- Anterior part of oesophagus and spear long, attenuated-----

----------Longidoridae (Thorne,1935) Meyl,1960.

Anterior part of oesophagus and spear usually not much long and attenuated----------5

5- Anterior part of oesophagus slender with short terminal bulb----------6

Anterior part of oesophagus not slender, posterior part more than 1/3 of neck-width long----------

----------Dorylaimidae De Man,1876.

6- Cuticle with strong radial muscles and fixation folds, oesophageal bulb pyriform----Belonenchidae Thorne,1964.

Cuticle without radial muscles and fixation folds; oesophageal bulb equal or less than 1/3 of total oesophageal length-----

----------7

7- Spear compound flanged; Basal bulb short, triqetrous; Gubernaculum present-------Aulolaimoididae Jairajpuri,1964.

Spear not compound, basal bulb equal to or less than 1/3 of the total oesophageal length; Gubernaculum absent-------

----------Leptonchidae Thorne,1935.

Family Dorylaimidae De Man, 1876.

DIAGNOSIS: Dorylaimoidea: Stoma with an axial spear; Spear extensions present. Amphids with obscure slit-like apertures. Posterior third or more of oesophagus enlarged. Lateral guiding pieces associated with the spicules; Gubernaculum absent.

TYPE SUBFAMILY: Dorylaiminae (De Man, 1876) Filipjev,1918.

KEY TO THE SUBFAMILIES OF DORYLAMIDAE De Man,1876.

1- Spear extension bearing flanges or knobs----------
----------Tylencholaiminae Filipjev, 1934.
Spear extension not bearing knobs or flanges----------2

2- Spear and spear extension very long, attenuated and slender--
----------Nordiinae Jairajpuri & Siddiqi, 1964.
Spear and its extension not so developed----------
----------Dorylaiminae (De Man,1876) Filipjev,1918.

Subfamily Tylencholaiminae Filipjev, 1934.

DIAGNOSIS: Dorylaimidae: Spear axial, spear extension rod-like, flanged or knobbed. Anterior part of oesophagus a relatively narrow tube, posterior part often shorter than in Dorylaiminae. Anterior pair of sub-ventral gland nuclei may be closer than is usual to the dorsal gland nucleus. Females with one or two gonads. Males with Dorylaimoid spicules and lateral guiding pieces.

An adanal pair and a ventro-median row of supplements present.

TYPE GENUS: Tylencholaimus De Man, 1876.

KEY TO THE GENERA OF TYLENCHOLAIMINAE FILIPJEV, 1934.

1- Lip region discoid with anterior disc----------Discomyctus Thorne,1939.

Lip region cylindrical, narrow or often cap-like----------2

2- Spear 2 head-widths long, spear extension without basal enlargements----------Utahnema Thorne, 1939.

Spear short, spear extension knobbed or flanged----------3

3- Amphids elongate conoid----------Miranema Thorne, 1939.

Amphids cup-like or stirrup-shaped----------4

4- Spear extension with small basal knobs----------Tylencholaimus De Man, 1876.

Spear extension rod-like or with broad flanges----------Enchodelus Thorne,1939.

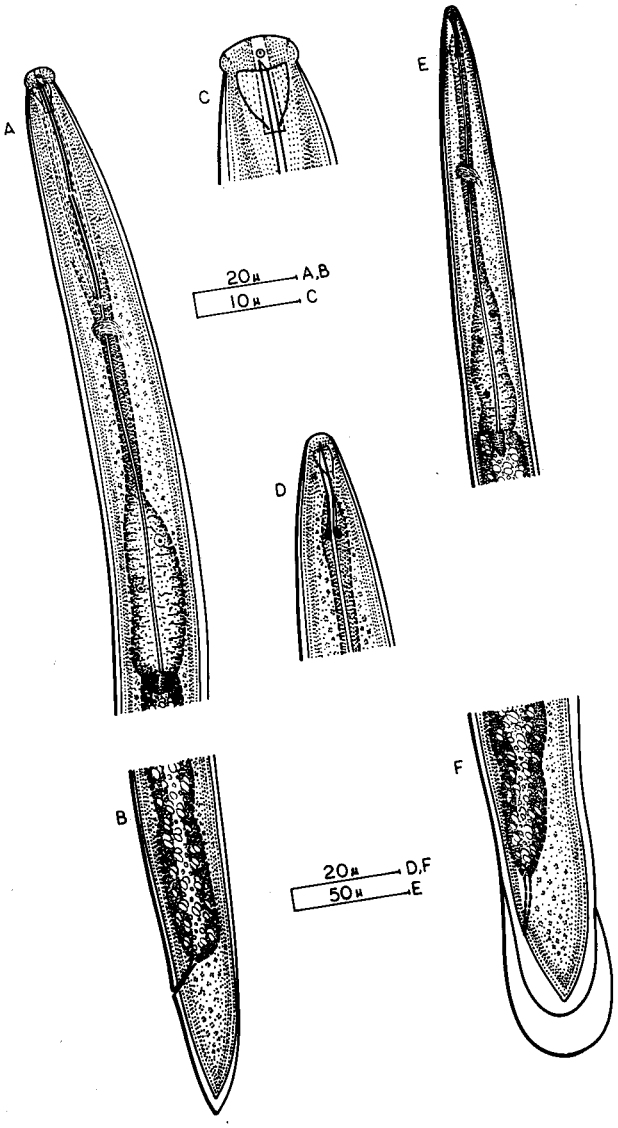
Genus Tylencholaimus De Man, 1876.

DIAGNOSIS: Tylencholaiminae: Body fairly robust. Cuticle with distinct radial striae. Lip region often cap-like. Spear Dorylaimoid, usually about as long as head-width; spear extension with small basal knobs. Oesophagus Dorylaimoid, anterior part with visible radial muscles, posterior part wider and cylindrical. The anterior pair of sub-ventral gland nuclei are closer to that

Plate No. 25.

Fig. A-C. *Longidorella minutissima* n.sp. A- Head end; B- Tail end; C- Head enlarged.

Fig. D-F. *Tylencholaimus clavicaudatus* n.sp. D- Head enlarged; E- Head end; F- Female tail.


A
B
C
D
E
F
20 µ A,B
10 µ C
20 µ D,F
50 µ E

of the dorsal gland than in most dorylaims. Ovaries paired or single; when one usually prodelphic (except in T. zealandicus). Spicules dorylaimoid, lateral guiding pieces present. Testes two. Supplements consisting of an adanal pair and a ventral row of 3 or more. Sub-median papillae not observed on the male.

TYPE SPECIES: Tylencholaimus mirabilis (Butschli,1873) De Man, 1876.

Syn. Tylenchus mirabilis Butschli, 1873.

Tylencholaimus clavicaudatus n.sp.

(Plate No. 25 ; Fig. D-F.)

MEASUREMENTS OF SIX FEMALES: L = 0.86-0.98 mm; a = 35-38; b = 5.0-5.5; c = 40-42; v = 35-36 %; spear = 10 µ; spear extension = 10 µ.

DESCRIPTION:- Body cylindrical, nearly straight when relaxed by gentle heat. Head end blunt. Cuticle and sub-cuticle apparently smooth. Lip region continuous with the body contour and about 1/4-1/5 as wide as body at base of oesophagus. Amphids cup-like, its aperture 3/4 as wide as head. Spear 10 µ long, more than the head-width, with its aperture occupying 1/5 of its length. Spear extension equal to the spear, provided with small basal knobs.

Guiding ring single. Oesophagus a narrow cylindrical tube in more than half of its length, enlarged in posterior position. Three oesophageal gland nuclei visible. Cardia cylindroid. Nerve ring crosses anterior slender oesophagus near its middle. Rectum slightly less than the anal-body width long. Pre-rectum more than the anal-body width in length.

Vulva a transverse slit; vagina at right angles to the body axis. Ovary single, posterior and reflexed. Tail broadly rounded and clavate, slightly more than the anal-body width long. Terminal cuticle of the tail quite thick resulting in the clavate terminus. Two pairs of caudal pores present.

Males not found.

HOLOTYPE: Females, Slide No. 691, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of *Pome granate* L.

TYPE LOCALITY: Dehradoon, U.P., India.

DIAGNOSIS AND RELATIONSHIP: *Tylencholaimus clavicaudatus* n.sp. comes closer to *T. gertii* Kruger, 1965 but differs from it in shape of tail, position of vulva(V=46% in *T.gertii*)and length of tail (C = 22-24 in *T. gertii*).

Recently Jairajpuri (1965) described three new species of *Tylencholaimus* from India and gave a key to the species of the genus. Since then some more species have been added to the genus,

therefore, a revised key to the species of the genus is presented here.

KEY TO THE SPECIES OF TYLENCHOLAIMUS De Man, 1876.
(After Jairajpuri, 1965)

1- Ovaries paired----------2
Ovary single ----------3

2- Length about 1 mm or less; V = 56%---*teres* Thorne,1939.
Length 1.4-1.8 mm; V = 50-52%---*viduus* Jairajpuri, 1965.

3- Ovary posterior to vulva----------4
Ovary anterior to vulva----------6

4- Tail elongate, dorsally convex-conoid with terminal portion dorsally bent, c=11----------*hastatus* Siddiqi, 1964.
Tail blunt convex-conoid or broadly rounded and clavate----- 5

5- Terminal core of the tail possesses a characteristic bowl shaped form; c = 22-24; V = 46%----*gertii* Kruger, 1965.
Terminal tail cuticle very thick, giving clavate shape to the tail c =40-42; V = 35-36%------*clavicaudatus* n.sp.

6- C = 42 or less.----------7
C = 50 or more ----------15

7- Tail very long (C=8.6-12.0), ventrally arcuate----------8
Tail short (C = 20 or more) ----------10

8- Tail elongate, conical in anterior third, then sub-cylindroid, but slightly bent to ventral side----------leptonchoides Loof, 1964.

Tail uniformly elongate-conoid, ventrally curved----------9

9- L = 0.56-0.62 mm; C = 8.6-9.5 ----------macrurus Siddiqi, 1964. 1964*

L = 0.72-0.82 mm; C = 11-12 ----------similis Jairajpuri, 1965.

10- Tail irregularly conoid to sub-digitate----------mirabilis (Butschli, 1873) De Man,1876.

Tail uniformly conoid to hemispheroid----------11

11- Inner portion of lip region set-off, discoid----------minimus De Man,1876.

Inner portion of lip region not set-off----------12

12- Spear extension more than twice the spear length----------vigil Andrassy, 1959.

Spear extension less than twice the spear length----------13

13- Basal knobs of spear extension well developed; L=0.5 mm; b = 2.8; c = 25-28----------proximus Thorne,1939.

Basal knobs of spear extension poorly developed; L = 0.65-0.95 mm; b = 3.5-4.5; c = 30-40 ----------14

14- Cuticle and sub-cuticle striated, males known----------dorae Kruger, 1965.

Cuticle and sub-cuticle unstriated; males not known----------obscurus Jairajpuri, 1965.

15- L = 0.6 mm---------- nannus Thorne,1939.

L = 1 mm or more---------- ♂ tecki Steiner,1914.

Tylencholaimus parateres Meyl, 1957 is not included in the key because only a male of this species is known. The two species viz. T.dorae Kruger, 1965 and T.obscurus Jairajpuri, 1965 are very similar to each other through description, diagrams and measurements. They appear to be synonyms of one another. As the exact date of their publication is not available, therefore, the author has left their synonymy for future till details are available.

The subfamily Nordianae Jairajpuri & Siddiqi, 1964.

DIAGNOSIS: ~~Longidoridae~~ Dorylaimidae: Body short and robust with yellowish or brownish appearance. Spear long and atlenuated with equal or sub-equal spear extensions; junction of spear and spear extension surrounded by an elongate swelling, guiding ring single, located near the middle or the apex of the spear. Oesophagus about 1/3-1/4 body length, comprised of an anterior slender and a broad elongate posterior glandular portion. Vulva slightly anterior to slightly posterior to middle of body. Ovaries amphidelphic and reflexed. Vaginal walls with or without cuticularized rim. Supplements consisting of an adanal pair and a ventro median series begining anterior to range of spicules. Males rare. Tail

terminus variable.

TYPE GENUS: Nordia Jairajpuri and Siddiqi, 1964.

KEY TO THE GENERA OF NORDIANAE JAIRAJPURI & SIDDIQI,1964.

1- Anterior portion of oesophagus slender, non-muscular setoff by a distinct constriction----------
----------Longidorella Thorne,1939.
Anterior portion of oesophagus narrow, muscular, not set-off by constriction----------2

2- Vaginal wall sclerotized----------
----------Enchodorella Khan, 1964.
Vaginal wall not sclerotized----------3

3- Spear guiding ring in the middle of spear, vulva posterior to middle of body and tail dorsally convex-conoid, subdigitate or with acute terminus----------
----------Nordia Jairajpuri & Siddiqi,1964.
Spear guiding ring near the apex of the spear, vulva anterior to middle of body and tail hemispheroid to rounded ----------Thornedia n.gen.

The Genus Thornedia* n.gen.

DIAGNOSIS: Nordianae: Cuticle and sub-cuticle appearing to be unstriated. Head continuous, narrower than front end of body

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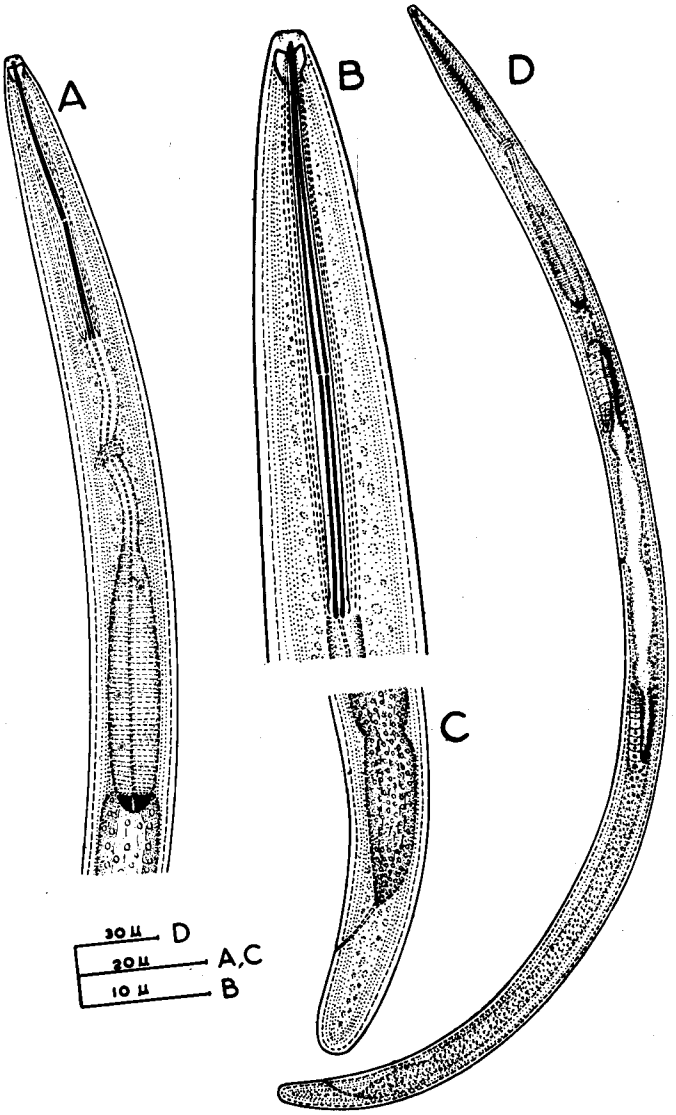
* Named after Prof. Gerald Thorne, Nematologist, Department of Plant Pathology, State College Brookings, South Dakota, U.S.A.

Plate No. 26.

Fig. A-D. *Thornedia solani* n.gen., n.sp. A- Oesophageal region; B- Head enlarged; C- Female tail; D- Female.


A
B
C
D
30 µ
D
20 µ
A,C
10 µ
B

with a slight depression at the oral opening. Lips amalgamated. Amphids stirrup-shaped with broad slit-like apertures. Spear greatly attenuated with sub-equal extension and without basal knobs or flanges. Spear guiding ring single, located near the apex of the spear. Anterior portion of the oesophagus narrow, muscular, expanding to a wide elongate basal portion. Vulva-transverse, slightly anterior to middle of body. Ovaries amphidelphic and reflexed. Tail hemispheroid to rounded. Males not known.

TYPE AND ONLY SPECIES: Thornedia solani h.gen., n.sp.

Thornedia solani n.gen., n.sp.
(Plate No.26; Fig.A-D.)

12 FEMALES: L = 0.41-0.47 mm; a = 20-30; b = 3.1-4.4;
c = 21-26; v = 15-17 45-49%; 17-19 Spear = 22-27 µ;
spear extension = 20-24 µ.

DESCRIPTION: Body robust, cylindrical, ventrally curved on death. Cuticle and sub-cuticle without apparent striations. Head flat, narrower than front end of body with a slight depression at the oral opening, not set-off from the body contour. Lips amalgamated, lip region 1/3 the body-width at the neck base. Cephalic papillae 6+10. Amphids stirrup-shaped with broad slit-like apertures. Spear long and slender, 22-27 µ long; spear

extension 20-24 μ in length, without knobs or flanges. Spear guiding ring single, faint, situated near the apex of the spear. Oesophagus begining as a slender anterior portion crossed by nerve ring, then enlarged to a basal bulb, measuring 2/5-1/3 of the total oesophageal length. Cardia bluntly rounded to hemispheroid. Vulva a transverse slit. Ovaries amphidelphic and reflexed. Oocytes arranged in a single row except for a short region of multiplication. Pre-rectum 2.5 times the anal-body width long. Rectum equal to anal-body width long. Tail hemispheroid to rounded, nearly 1½ to twice the anal-body width long.

Males not found.

HOLOTYPE: Female, collected in December, 1963, Slide No.1102, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

PARATYPES: with the authors.

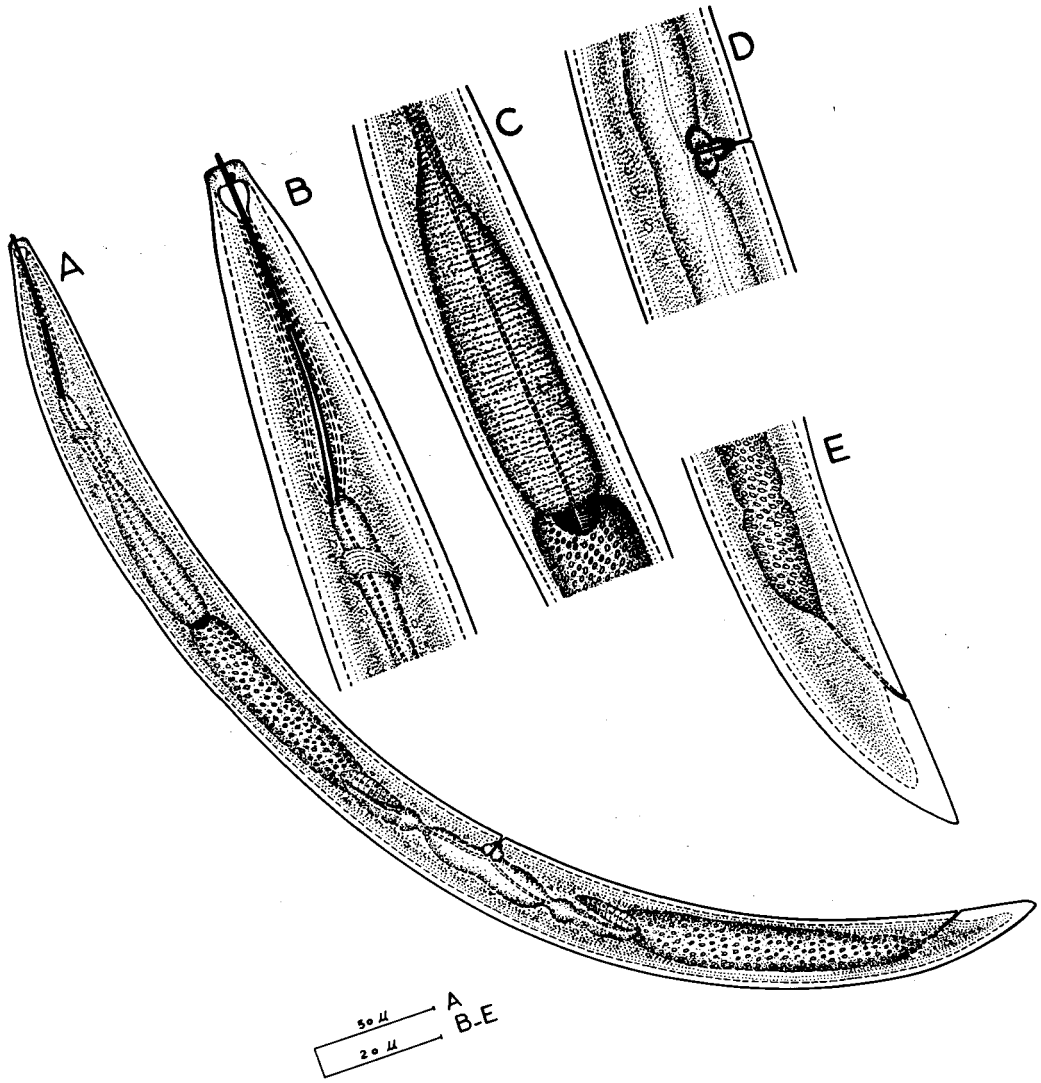
TYPE HABITAT: Soil around the roots of Solanum tuberosum L.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Thornedia n.gen. resembles Nordia Jairajpuri & Siddiqi, 1964 in general appearance, long attenuated spear, and not set-off basal portion of oesophagus, but differs in the presence of (1) spear guiding ring near the apex of the spear, in the middle of the spear in Nordia; (2) Vulva

Plate No. 27.

Fig. A-E. *Enchodorella mustafi* n.sp. A- Female; B- Head enlarged; C- Enlarged basal oesophageal region; D- Vulvar region; lateral; E- Female tail.


A
B
C
D
E
50 µ
A
20 µ
B-E

slightly anterior to middle of body, posterior to middle of body in Nordia; (3) hemispheroid to rounded tail terminus, dorsal convex conoid, subdigitate or with acute terminus in Nordia.

The Genus Enchodorella Khan, 1964.

DIAGNOSIS: Nordianae: Body short and plump, less than 1 mm lon Amphids stirrup shaped, with elongate slit-like apertures, located behind base of lateral lips. Oesophagus with a slender anterior part and a bulbous posterior part. Posterior part of oesophagus not set-off by a constriction from the anterior part. Spear long, attenuated, with simple, rod-like extensions. Gonads paired. Outer margins of vaginal wall with a heavily cuticularized rim. Pre-rectum short, about as long as rectum.

TYPE SPECIES: Enchodorella perveeni Khah, 1964.

Enchodorella mustafi* n.sp.

(Plate No.27;Fig.A-E.)

10 FEMALES: L = 0.53-0.57 mm; a = 16-19; b = 3.0-3.3;
c = 20-24; v = $\frac{6-8}{57-59}$%; Spear = 32-36 µ;

Spear extension = 32-36 µ.

DESCRIPTION: Body robust, cylindrical, gradually tapering at both extremities, assumes a slightly ventrally arcuate position when relaxed by gentle heat. Cuticle thick. Head rounded, set-off

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* Named after Dr. Abrar M. Khan, Reader, Deptt. of Botany, Aligarh Muslim University, Aligarh, U.P., India.

by a constriction, less than 1/3 as wide as body width at neck base. Amphids stirrup-shaped, 3/4 as wide as head, opening through crescentic apertures at base of lateral lips. Spear attenuated, 32-36 μ long. Spear extension rod-like, not swollen at base, nearly as long as the spear. Spear guiding ring single. Oesophagus divisible into two parts, viz., an anterior slender tube encircled by nerve ring and a posterior muscular bulb measuring approximately 1/3 of the total oesophageal length. Anterior oesophageal part not set-off from the enlarged posterior portion by a constriction. Dorsal oesophageal gland emptying near anterior end of basal bulb. Oesophago-intestinal valve large rounded, Intestine with prominent lumen throughout. Vulva transverse. Vagina leading at right angles to body axis, its outer margins with a strongly cuticularized rim. Gonads paired, symmetrical, relaxed nearly half way back to vulva. Uterus thick walled. Oviducts long. Rectum slightly less than tail length and slightly more than the anal-body width long. Pre-rectum slightly more than the rectum length. Tail elongate-conoid, slightly dorsally convex, ending in a rounded terminus, about 1½ times the anal-body width long.

Males not found.

HOLOTYPE: Female, collected in December, 1963, slide No. 1106, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

PARATYPES: With the author .

TYPE HABITAT: Soil around the roots of Solanum tuberosum L.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Enchodorella mustafi n.sp. comes closer to E.perveeni Khan, 1964 in the position of vulva but differs in (1) size and width of the body; (2) length of the spear and spear extension; (3) set-off head; (4) tail terminus convex-conoid; subdigitate in E.perveeni; and (5) rectum and pre-rectum more than anal-body width long (equal to anal-body width in E.perveeni).

KEY TO THE SPECIES OF ENCHODORELLA KHAN, 1964.

1- Body length 0.65-0.75 mm; Spear and Spear extension more than 40 μ----------2

Body length 0.53-0.57 mm; Spear and spear extension less than 40 μ ----------mustafi n.sp.

2- Body robust, a = 12-15; tail convex-conoid with a sub-digitate terminus----------perveeni Khan, 1964.

Body slender; a = more than 15; tail with acute terminus----------americana (Tarjan,1953) Khan,1964.

Genus Longidorella Thorne, 1939.

DIAGNOSIS:- Nordianae: Body short and robust. Spear and spear extension long, extension without basal swellings. Anterior part

of oesophagus slender, non-muscular, set-off by a distinct constriction from the basal part of oesophagus. Amphids stirrup-shaped. Guiding ring appears to be more than a head-width from the anterior end. Tails short, similar in both sexes, dorsally convex-conoid. Spicules dorylaimoid.

Longidorella minutissima n.sp.

(Plate No.25 ;Fig. A-C.)

MEASUREMENTS: 10 females: L = 0.33-0.36 mm; a = 21-27; b = 3.1-3.4; c = 13-15; v = 59-60%.

Holotype female: L = 0.36 mm; a = 21; b = 3.1; c = 15; v = 59%.

DESCRIPTION: Body cylindrical, gradually tapering at the extremities, assumes a slightly ventrally arcuate position on death. Head rounded set-off by a constriction, half as wide as body at neck base (Fig.1,A). Amphids stirrup-shaped 3/4 as wide head, opening through crescentic apertures, at base of lateral lips. Spear attenuated, 23-25 μ long; spear extension rod-like, not swollen at base, 21-23 μ in length (Fig. I,B).

Oesophagus divisible into two parts viz., an anterior slender non-muscular tube and a posterior off-set muscular bulb measuring 2/7 of its length. Dorsal oesophageal gland prominent, emptying

near anterior end of basal bulb. Oesophago-intestinal valve large rounded. Nerve ring crossing oesophagus a little behind the base of spear extension, vulva transverse. Vagina leading inwards at right angles to body axis; its walls not sclerotized. Gonads paired, symmetrical, reflexed. Intestine with prominent lumen throughout. Pre-rectum equal to tail length. Rectum short, less than anal-body width. Tail elongate-conoid, slightly dorsally convex, ending in a sub-digitate and rounded terminus (Fig.I,C), about twice the anal-body width long. Male not found.

HOLOTYPE: Female, slide No. 1111, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University Aligarh, U.P., India.

TYPE HABITAT: Soil around roots of Solanum tuberosum L.

TYPE LOCALITY: Aligarh, U.P., India.

DIAGNOSIS AND RELATIONSHIP:- Longidorella minutissima n.sp. can at once be differentiated from all the species of the genus by having a very small body size. It comes closer to L.parva Thorne, 1939, from which it differs in having a smaller body-size, smaller buccal spear, a set-off head, and differently shaped tail.

KEY TO THE SPECIES OF LONGIDORELLIA THORNE,1941.

1- Vulva pre-equatorial----------impar Khan,1964.
Vulva equatorial or post-equatorial----------2

2. C = 50; lip region set off ----------pygmea (Steiner,1914).
C = less than 50 ----------3

3- Tail ventrally arcuate, c = 13-18----------4

Tail dorsally bent, elongate conoid, c = 11-12---------

----------*xenura* Khan & Siddiqi, 1963.

4- Head set-off; L = 0.33-0.36 mm;----------

----------*minutissima* n.sp.

Head continuous; L = 0.55 mm ----------

----------*parva* Thorne, 1939.

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Family Leptonchidae Thorne, 1935.

Since the publication of Thorne's (1936,39) monographs on Dorylaimid nematodes, six more new genera have been added in the family Leptonchidae, three by Thorne (1964), one by Lordello (1955) and two by Jairajpuri (1964). Therefore according to Jairajpuri (1964) and Thorne (1964) the family Leptonchidae consists of five sub-families and thirteen genera.

DIAGNOSIS: Dorylaimoidea: Body cylindrical. Cuticle and sub-cuticle smooth or finely striated. Sub-cuticle usually provided with dot-like radial elements, especially abundant near tail, sometimes shrinking and forming folds during fixation. Lateral pores in one or two lines. Spear axial sometimes very long (Aiphinemella) with strongly developed extension which is simple or may bear basal knobs or flanges. Oesophagus a slender tube with a short basal bulb rarely reaching 1/3 length of neck, may be set-off by a distinct constriction. Oesophagal lumen not forming a broad triquetrous chamber in the basal bulb. Prerectum present. Testes paired, dorylaimoid. Adanal pair of supplements and lateral guiding pieces present. Gubernaculum absent.

TYPE SUBFAMILY: Leptonchinae Thorne, 1935.

KEY TO THE SUBFAMILIES OF LEPTONCHIDAE THORNE,1935.

1- Expanded portion of oesophagus bibulbar ----------
----------Qudsianematinae Jairajpuri,1965.
Expanded portion of oesophagus not bibulbar----------2

2- Head provided with six small perioral liplets; lumen of basal bulb forming a small triquetrous chamber----------
----------Tyleptinae Jairajpuri, 1964.
No such structure present----------3

3- Spear extension flanged or knobbed----------4
Spear extension simple----------Leptonchinae Thorne,1935.

4- Spear and spear extension very long; Head provided with labial disc-----Xiphinemallinae Jairajpuri,1964.
Spear and spear extension short----------
----------Tylencholaimellinae Jairajpuri, 1964.

Subfamily Tylencholaimellinae Jairajpuri,1964.

DIAGNOSIS: Leptonchidae: Small nematodes less than 1.5 mm long with robust straight or slightly arcuate bodies and rounded tails. Spear extension provided with well developed basal flanges or knobs. Oesophagus a slender tube with short basal bulb, sometimes set-off by a constriction. Vestibule with or without sclerotized pieces.

TYPE GENUS: Tylencholaimellus M.V.Cobb,1915.

KEY TO THE GENERA OF TYLENCHOLAIMELLINAE JAIRAJPURI,1964.

1- Ovary single----------2

Ovaries paired----------Phellonema Thorne, 1964.

2- Spear without a stiffening piece----------

----------Doryllium Cobb, 1920.

Spear with a stiffening piece----------3

3- Stiffening piece dorsal, equal to spear length; posterior sexual branch normal----------Tylencholaimellus Cobb,1915.

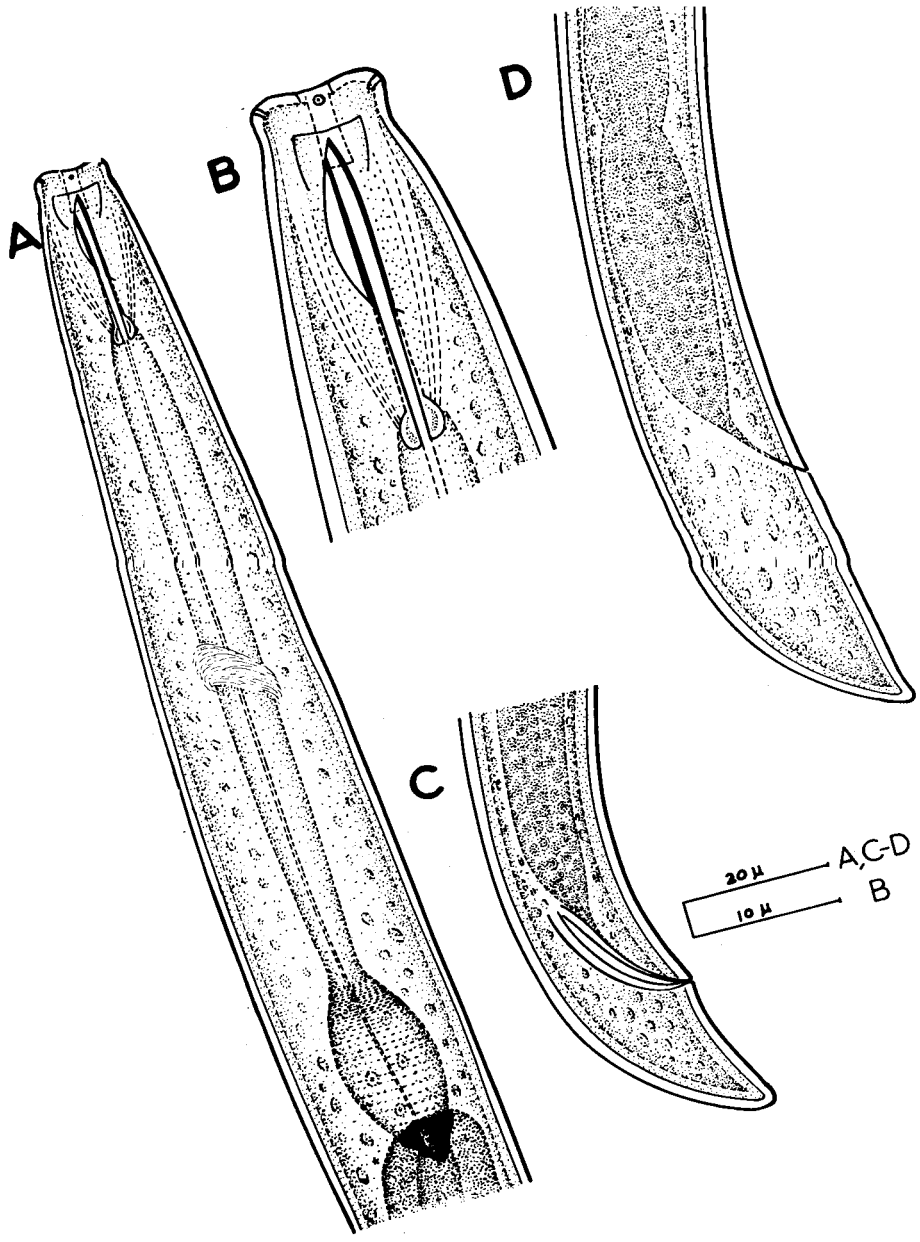
Stiffening piece ventral, about 1/3 of spear length; anterior sexual branch normal------Dorella Jairajpuri,1964.

Genus Tylencholaimellus Cobb,1915.

DIAGNOSIS: Tylencholainellinae: Spear with an additional dorsal stiffening piece; spear extension knobbed or strongly flanged. Oesophagus a slender tube with short, offset terminal bulb. Vulva far forward in body. Gonad single, posterior, reflexed; anterior branch a rudimentary sac or absent. Pre-rectum present. Spicules frail ,dorylaimoid, with lateral guiding pieces. Gubernaculum absent. Supplements consisting of an adanal pair and a single ventromedian one. Tails of both sexes similar, hemispheroid to

Plate No. 28.

Fig. A-D. *Tylencholaimellus thornei* n.sp. A- Oesophageal region of female; B- Female headd enlarged; C- Male tail; D- Tail end of female.


A
B
C
D
20 µ
A,C-D
10 µ
B

bluntly rounded.

TYPE SPECIES: Tylencholaimellus diplodorus N.A. Cobb in M.V. Cobb, 1915.

Tylencholaimellus thornei n.sp.

(Plate No. 28 ;Fig. A-D.)

L = 0.54-0.62 mm; a = 25-30; b = 4.1-5.5; c = 22-28; v = $^{4}40\text{-}46\%^{20}$; spear = 10-12 microns; spear extension = 8.0-9.5 microns.

L = 0.52-0.55 mm; a = 25-35; b = 4.3-5.8; c = 23-25; spicules = 23-25 microns; spear=10.0-12.0 microns; spear extension = 8.0-9.0 microns.

DESCRIPTION: Body short, cylindrical, slightly ventrally curved when relaxed by gentle heat. Cuticle smooth, sub-cuticle finely annulated, annulations prominent in the tail region. Lip region slightly set-off from the body contour by a depression, nearly 1/2.5th of the body width at the neck base. Amphids half as wide as head. Spear with dorsal stiffening piece, slightly longer than the spear extension; spear long with the flanged spear extension equal to the twice of the head width. Elongate funnel-like guiding ring present in (Fig. I,D). Oesophagus begining as a slender tube, later expanding in a short set-off basal bulb measuring 1/5.5th of the total oesophageal length or marly equal

to the body-width at that point. Five gland neclei visible in the basal bulb. Nerve ring crossing the anterior part of the oesophagus at about 63.0-68.0 microns apart from the anterior end of the body. Cardia conical. Pre-rectum 2½ times the anal-body width long. Rectum 1/1.5th of the tail length. Tail conoid to rounded, more than the anal-body diameter long.

Vulva situated anterior to the middle of the body. Vagina thick walled. Ovary single, opisthodelphic, reflexed about half way back to vulva. Anterior uterine branch present, nearly one-third the body-width long. Two pairs of caudal pores present.

MALE: In general appearance and measurements similar to females. Gonads paired, outstretched; spicules ventrally arcuate, frail with lateral guiding piece, nearly 23.0-25.0 microns long. Supplements consisting of an adanal pair and sub-ventral one. Two pairs of caudal pores present. Tail tapering to a bluntly conoid to rounded terminus, somewhat similar to female tail.

HOLOTYPE: Female collected in December, 1963, slide No. 1140, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male collected with the females; other data same as for holotype.

TYPE HABITAT: *Prunus persica* L.

TYPE LOCALITY: Dehradun, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Tylencholaimellus thornei n.sp. comes closer to T. montanus Thorne, 1949, T. coronatus Thorne,1949 T. striatus Thorne, 1949 and T.eskei Siddiqi and Khan, 1964, but can be separated:

from T.montanus due to the (a) presence of males; (b) elongate funnel-like guiding ring as against simple guiding ring and (c) basal bulb equal to neck width (1½ times the neck-width in T.monta

from T.coronatus due to the (a) presence of a refractive disc abou the mouth; (b) position of vulva and (c) presence of males. From T.striatus in the presence of anterior uterine branch and the position of vulva;

from T.eskei in the position of vulva; presence of males; shape of cardia; absence of swelling in anterior oesophageal bube; size of the anterior uterine sac; and the presence of pre-rectum and males.

KEY TO THE SPECIES OF TYLENCHOLAIMELLUS COBB,1915.
(Modified after Siddiqi and Khan,1964)

1- Labial disc present----------2

Labial disc absent----------6

2- Anterior uterine sac present----------3

Anterior uterine sac absent----------Sayeedi Siddiqi, 1965.

3- Anterior uterine sac less than body width long----------4
Anterior uterine sac as long as or longer than body width----5

4- Amphids almost as wide as lip region width; tail convex-conoid----------montanus Thorne, 1939.
Amphids a little more than half the lip region width; tail cylindrical----------striatus Thorne, 1939.

5- Amphids stirrup-shaped; labial disc unsclerotized----------projectus Siddiqi,1964.
Amphids elongate, labial disc sclerotized----------coronatus Thorne, 1939.

6- Body small, 0.62 mm or shorter----------7
Body large, 0.65 mm or longer----------9

7- Body length 0.33 mm; a = 15.3----------mariannae Andrassy, 1958.
Body length 0.53-0.62 mm; a = 25-30 ----------8

8- V = 33-37%; males not known------eskei Siddiqi & Khan,1964.
V = 40-46%; males known----------thornei n.sp.

9- Total length of spear about 4 x lip region width----------diplodorus Cobb,1915.
Total length of spear about 3 x lip region width or less----------10

10- Vulva at 37-41 % of body; anterior uterine sac 2.3 body width long----------raskii Jairajpuri, 1963.

Vulva at less than 36% of body; anterior uterine sac less than 2 x body width long----------11

11- Spear 3 x lip region width long----------12

Spear less than 3 x lip region width long----------13

12- Body length 1.4 mm; v = 25 %----------

----------sagittifer (De Man,1921) Thorne,1939.

Body length 0.9 mm; v = 33 %----------

----------magnidens Thorne, 1939.

13- Oesophageal region short, b = more than 6 ----------14

Oesophageal region long, b = less than 6 ----------15

14- Lip region set-off by a constriction----------

----------polonicus Szczygiel, 1962.

Lip region not set-off by a constriction----------

----------affinis (Blakenhoff,1914) Thorne,193

15- Tail longer than anal-body width----------

----------alpinus (Altherr,1950) Altherr,1952.

Tail shorter than anal-body width----------16

16- Body size 0.88 mm or less; males known----------17

Body size 1 mm; males not known------acris Thorne, 1964.

17- Body plump, ventrally arcuate; supplements consisting of a pre-anal pair and a ventro-median papillae at 40 u anterior from cloaca---------pluvialis Siddiqi, 1965.

Body practically straight, supplements consisting of an adanal pair only ----------macrophallus Thorne, 1964.

Subfamily Leptonchinae Thorne, 1935.

DIAGNOSIS: Leptonchidae: Spear extension simple, without knobs or flanges, weakly or strongly sclerotized, arcuate or angu Oesophagus slender tube with a short basal expansion (rarely reaching one third the neck length in some Dorylaimoides) which is set-off by a constriction in Proleptonchus. Tails varying from hemispheroid in Leptonchus to elongate-conoid in Dorylaimoid Cuticle sometimes with strong radial striae.

TYPE GENUS: Leptonchus Cobb, 1920.

KEY TO THE GENERA OF LEPTONCHINAE THORNE,1935.

1- Basal oesophageal bulb set-off----------2

Basal oesophageal bulb not set-off----------3

2- Stoma flask-shaped----------Proleptonchus Lordello,1955.

Stoma funnel-shaped----------

------Shamimonema (Jairajpuri,1964) Chowla et al, 1965.

3- Tails elongate, conoid to filiform----------4

Tails blunt, rounded----------5

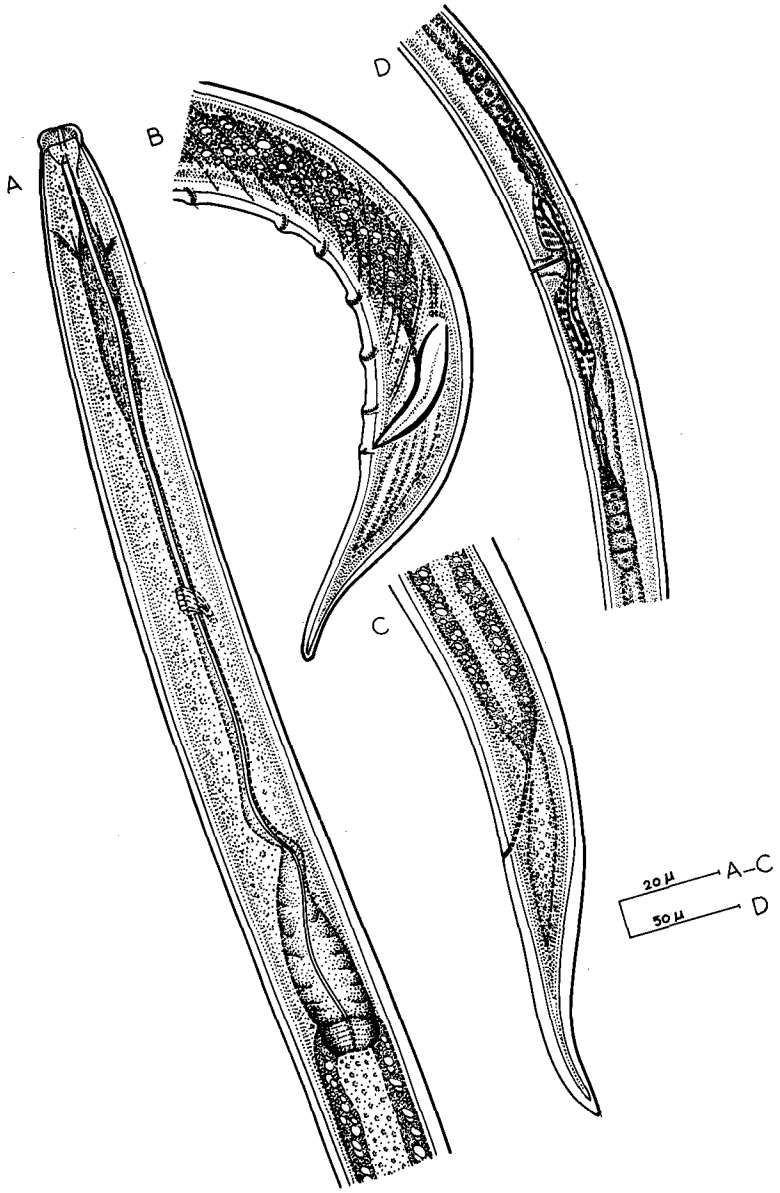
4- Spear extensions parallel, tails never filiform----------

----------Agmodorus Thorne,1964.

Spear extension divergent----Dorylaimoides Thorne, 1935.

Plate No. 29.

Fig. A-D. *Dorylaimoides leptus* n.sp. A- Head end of female; B- Male tail; C- Female tail; D- Female reproductive region.


A
B
C
D
20 µ
A–C
50 µ
D

5- Oesophageal bulb 3 times as long as wide----------
----------Doryschota Thorne, 1964.
Oesophageal bulb twice as long as wide----------
----------Leptonchus Cobb, 1920.

Genus Dorylaimoides Thorne, 1935.

DIAGNOSIS: Leptonchinae: Tails of both sexes similar, varying from blunt to filiform. Lip region generally rounded, nearly angular. Spear with divergent extensions, the dorsal element often fused to the spear making a long shaft. Oesophagus with rather weak bulb rarely 1/3 of neck length. Ovaries paired or single. Syngomic or bisexual. Supplements 2-7, well spaced. Spicule without abrupt ventral angle.

TYPE SPECIES: Dorylaimoides teres Thorne, 1935.

Dorylaimoides leptus n.sp.

(Plate No. 29 ;Fig. A-D.)

MEASUREMENTS OF EIGHT FEMALES: L = 0.86-1.3 mm; a = 38-47; b = 4.8-6.3; c = 16.6-20.1; v = $^{10-11}_{45-48\%}$.$^{14-15}$

MEASUREMENTS OF THREE MALES: L = 1.1-1.3 mm; a = 43-45; b = 5.8-6.2; c = 22.7-23.3; spicules = 31-34 µ.

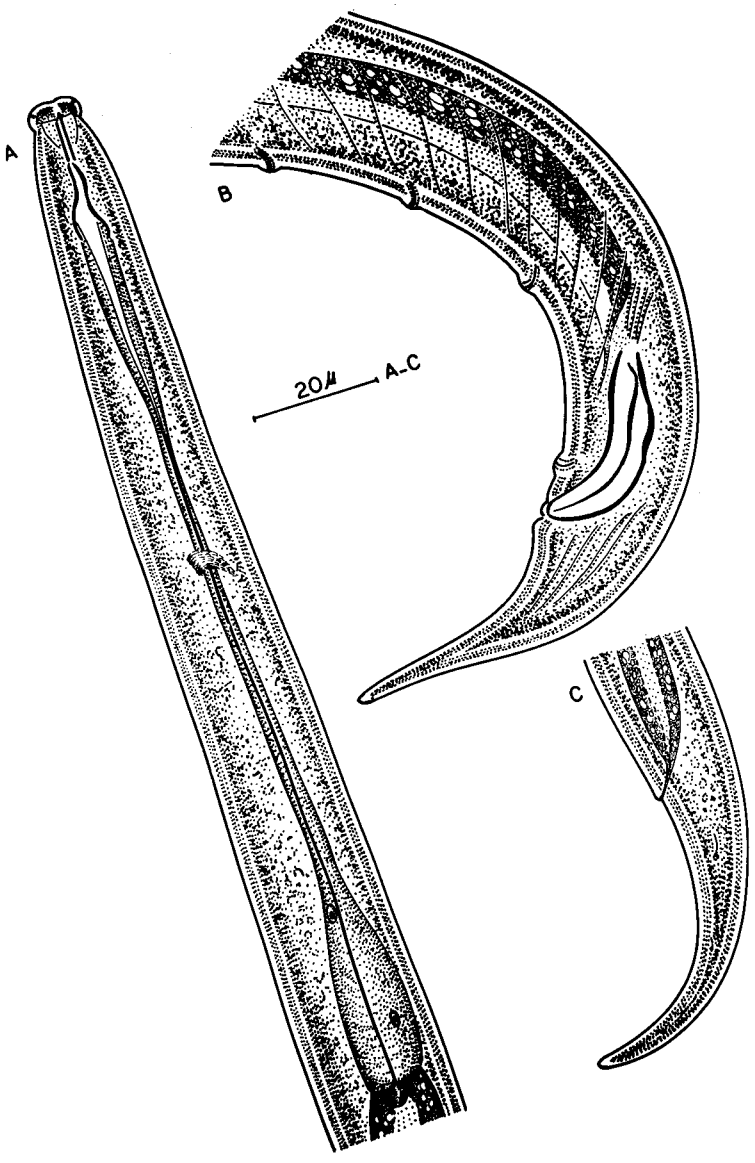
DESCRIPTION: Body ventrally arcuate on death, marked by longitudinal striae. Cuticle and sub-cuticle smooth. Lip region hemispherical, set-off from the body by a distinct constriction. Amphids stirrup-shaped, extending to 3/4 of the head-width. Spear cylindrical, equal to the lip-region width, its aperture 2/7 of its length. Spear extension 1½ times of the spear length. Spear guiding ringle simple, near anterior end of the spear. Oesophagus begins as a slender anterior part followed by a median narrowed portion and a posterior off-set enlarged bulbar portion, which is nearly three times as long as wide. Nerve ring located near the anterior end of median narrowed part. Cardia conoid.

Vulva a transverse slit; vagina extending into the body more than half its width. Circular globular area is distinct which is formed by the muscles around the vagina. Gonads paired, opposed, asymmetrical and reflexed; uteri with no sperms. Pre-rectum 35 μ in length. Rectum longer than anal-body width. Post-anal intestine present. Tail elongate, regularly conoid to rounded terminus, dorsally bent, less than three anal-body width long. Tail end appearing digitate.

MALES: Similar to females in general shape and appearance. Testes paired, dorylaimoid. Spicules stout, 31-34 μ in length. Supplements in the form of an adanal pair and a ventro median series of five papillae, begining slightly less than one spicular

Plate No. 30

Fig. A-C. *Dorylaimoides elongatus* n.sp. A- Oesophageal region of female; B- Male tail; C- Female tail.


A
B
20μ
A-C
C

length anterior to cloaca, first four at about the same distance from one another and the fifth at considerably greater distance. Tail digitate, bent dorsally.

HOLOTYPE: Female, Slide No. 731, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University Aligarh, U.P., India.

ALLOTYPE: Male, collected with the female, other data same as for holotype.

TYPE HABITAT: Soil around the roots of *Rosa* sp.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: *Dorylamoides leptus* n.sp. comes closer to *D.parvus* Thorne and Swanger, 1936 and *D.pakistanensis* Siddiqi, 1963. It differs from the former in the position of vulva, shape of the lip region and in the presence of post-anal intestine; from the latter in the length of tail, asymmetrical ovaries, position of vulva; size of pre-rectum, presence of post-anal intestine; smooth sub-cuticle; size of the spicules and in the arrangement of supplements in males.

Dorylaimoides elongatus n.sp.

(Plate No. 30 ; Fig. A-C.)

MEASUREMENTS OF NINE FEMALES: L = 0.78-1.0 mm; a = 37.0-42.4; b = 4.5-6.3; c = 12.5-19.9; v = 33.7-44.0%; spear = 5.5-7.0 µ; spear extension = 11.0-12.5 µ.

MEASUREMENTS OF THREE MALES: L = 0.83-0.94 mm; a = 33.0-41.5; b = 5.7-5.8; c = 16.0-22.2; spear = 6 μ; spear extension = 11-12 μ; spicules = 27-36 μ.

DESCRIPTION: Body cylindrical, ventrally arcuate on death, tapering on both extremities. Cuticle and sub-cuticle smooth. Lip region hemispherical, set-off from the body by a distinct constriction. Amphids stirrup-shaped, extending to 3/4 of the head width. Spear cylindrical, nearly equal to the lip-region width; its aperture 1/5 of its length. Spear extension almost twice of the spear length, divergent. Oesophagus begins as a slender anterior tube followed by a median narrowed portion and then the posterior offset ~~mk~~ enlarged bulbar portion which is three times as long as wide. Nerve ring located near the middle of the oesophagus. Cardia conoid. Rectum short, half the anal-body width long. Pre-rectum equal to the anal-body width. Tail elongate, regularly conoid to rounded terminus, ventrally arcuate, slightly less than four times the anal-body width long.

Vulva a transverse slit. Ovary single, posterior, reflexed. Anterior uterine sac 1½ times the vulvar-body diameter long.

Males similar to females in general shape and appearance. Testes paired, reflexed. Spicules paired, typically dorylaimoid, 27-36 μ in length. Tail conoid at first then tapering abruptly to a rounded terminus, ventrally arcuate, less than three times

the cloacal-body width. Six pairs of pre-anal supplements present and no post-anal; two pairs are adanal out of six supplements.

HOLOTYPE: Female, slide No. 732, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of Prunus persica L.

TYPE LOCALITY: Vallipura

DIAGNOSIS AND RELATIONSHIP: Dorylaimoides elongatus n.sp. comes closer to D.modestus Siddiqi, 1965 but differs from it in the larger body size, offset lip region, presence of males and position of vulva (V = 31-35 % in D.modestus).

KEY TO THE SPECIES OF DORYLAIMOIDES THORNE,1935.

1- Ovary single----------2

Ovaries paired----------13

2- Tail 4 or less 4 x anal-body width long----------3

Tail more than four anal-body width long----------4

3- Tail 2 x anal-body width long; L = 0.96-1.4 mm ----------

----------daotylurus Heyns, 1963.

Tail more than 2 x anal-body width long----------

4- Tail bluntly conoid----------*pretoriensis* Heyns,1963.

Tail elongate-conoid----------5

5- Lip region hemispherical----------6

Lip region angular----------*reversus* Thorne,1964.

6- Lip region set-off; L = 0.78-1.0 mm; v = 33.7-44.0%;

males known----------*elongatus* n.sp.

Lip region continuous, L = 0.72-0.79 mm; v = 31-35%;

males not known----------*modestus* Siddiqi, 1965.

7- Tail more than 8 x anal-body width long----------8

Tail less than 7 x anal-body width long----------10

8- Tail 10 or less anal-body width long----------9

Tail 11 x anal-body width long----*longiurus* Siddiqi, 1965.

9- Tail about 10 x anal-body width long----*conurus* Thorne,1939.

Tail about 9 x anal-body width long---*brevidens* Thorne,1964.

10- Anterior uterine branch absent-----*riparius* Andrassy,1962.

Anterior uterine branch present----------11

11- Tail ventrally arcuate----------12

Tail not ventrally arcuate----*venustus* Andrassy,1962.

12- Body length 0.9 mm; v = 36 %-----*intermedius* Thorne, 1964.

Body length 1.01 mm; v = 33%-----*arcuatus* Siddiqi, 1963.

13- Body length 4-6 mm----------

----*ditlevseni* (Micoletzky,1922) Thorne and Swanger,1936.

Body length less than 3 mm----------14 -.i4

14- Tail rounded or bluntly conoid----------15

Tail conoid, sub-digitate, digitate or attenuated--------17

15- Spear extension forming a sclerotized chamber ----------

----------thecolaimus Heyns,1962.

Spear extension normal----------16

16- Basal enlarged part 1/3 of oesophagus; tail conoid rounded----------teres Thorne and Swanger,1936.

Basal enlarged part 1/4 of oesophagus; tail obtusely rounded----------parateres Siddiqi, 1963.

17- Tail relatively short; c = 20 or more ----------18

Tail relatively long; c = less than 20 ----------20

18- Tail conoid, sub-digitate at end----------

------elegans (De Man, 1880) Thorne and Swanger,1936.

Tails digitate----------19

19- Basal bulb 1/4 of the oesophagus; v = 46-55 % ----------

----------rhabdotus (Kreis,1930) Thorne & Swanger,1936.

Basal bulb 1/3 of the oesophagus: v = 43%----------

----------micoletzkyi (De Man,1921) Thorne & Swanger,1936.

20- Body length 2.7 mm; tail over 10 x anal-body width long--

----------longicaudatus (Imamura,1931) Thorne & Swanger,1936

Body length under 2 mm; tail less than 10 x anal-body width long----------21

21- V = less than 38%----------22

V = 40% or more----------24

22- Head conoid, basal bulb 1/3 of the oesophageal length---

----------parvus Thorne and Swanger, 1936.

Head smoothly rounded; basal bulb 1/4 of the

oesophageal length----------23

23- C = 11; V = 34%; pre-rectum = 5-6 times the anal-body

width long----------similis Thorne, 1964.

C = 7.1-8.3; V = 35-38%; pre-rectum = 3-4 times the

anal-body width long----------elaboratus Siddiqi,1965.

24- Tail end filiform.----------25

Tail end conoid or digitate----------26

25- Tail 5.5-6 x anal-body width long----------

----------pulbuchneri Meyl, 1956.

Tail 9 x anal-body width long---leptura Siddiqi, 1965.

26- V = 40-48%----------27

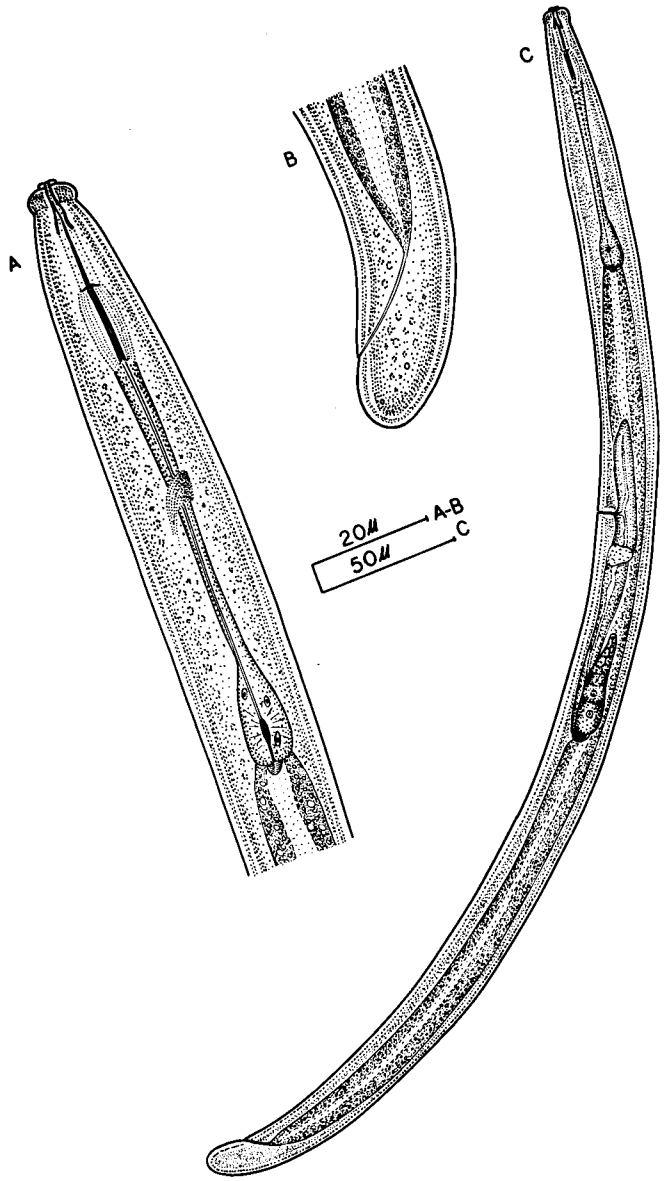
V = 52-54%----------porifer Loof, 1964.

27- V = 40-42%; C = 12.5-16.0-----pakistanensis Siddiqi,1964.

V = 45-48%; C = 16.6-20.1-----leptus n.sp.

Plate No. 31.

Fig. A-C. *Basirotylepthus modestus* n.sp. A- Oesophageal region; B- Female tail; C- Female.


A
B
C
20µ
A-B
50µ
C

Family Basirotyleptidae Siddiqi & Khan, 1965.

DIAGNOSIS: Dorylaimoidea: Spear axial, solid, needle-like, with simple extension. Amphids stirrup-shaped, with wide slit-like apertures. Oesophagus slender, expanding at base into an small bulb, the latter usually showing compact cuticular thickening of its inner wall. Excretory pore absent. Pre-rectum present. Males, where known, with an adanal pair of papillae, located a little anterior to cloaca, reduced supplements and dorylaimoid spicules. Gubernaculum and bursa absent in male.

TYPE AND ONLY GENUS: Basirotyleptus Jairajpuri, 1964.

Syn. Trichonchium Siddiqi & Khan, 1964.

Genus Basirotyleptus Jairajpuri, 1964.

DIAGNOSIS: Basirotyleptidae: characters of the family.

Basirotyleptus modestus n.sp.

(Plate No. 31; Fig. A-C.)

MEASUREMENTS OF FIFTEEN FEMALES: L = 0.46-0.53 mm; a=22.4-26.2; b = 4.7-5.9; c = 41.8-44.3; v = 36.6-42.7%; spear = 15-19 µ; Spear extension = 13-18 µ.

DESCRIPTION: Body cylindrical, gradually tapering anteriorly from base of neck to lip region which becomes 2/5 as wide as neck base. Body cuticle smooth, sub-cuticle finely striated. Amphids large, cup-shaped with broadly rounded base, opening at base of lateral lips through large sausage-shaped pores. Lip region rounded,

set-off from the body contour by a constriction. Labial disc present. Distal part of the stoma only slightly sclerotized, little less than the head-width; its posterior end not set-off to form a cup-like structure. Collar-like region of stoma close to its sclerotized part. Spear typical of the genus, 15-19 μ in length. Spear extension highly sclerotized, slightly arcuate, 13-18 μ long. Oesophagus a slender tube, expanding at its base to form an elongate bulb which is one body-width long. Sclerotization of the inner walls of the bulb forming an elongate pad-like refractive valvular apparatus. Cardia rounded. Rectum 3/4 anal-body width long. Pre-rectum twice the anal-body width in length. Tail hemispherical, 3/4 anal-body width long with a pair of caudal pores.

Vulva a small, elliptical, transverse slit. Vagina extending 1/4 vulvar-body width into the body with thick cuticular muscles. Anterior uterine sac 1½ times the vulvar-body width long. Ovary single, posterior, reflexed half way back to vulva with oocytes arranged in a single row.

MALE: not found.

HOLOTYPE: Female, Slide No. 890, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of a grass.

TYPE LOCALITY: Aligarh, U.P. India.

DIAGNOSIS AND RELATIONSHIP: Basirotyleptus modestus n.sp. comes closer to B.coronatus Siddiqi and Khan, 1965 and B.basiri Jairajpuri, 1964. It differs from the former in the smaller size of the body, shorter tail and long anterior uterine sac while from the latter in presence of lab-ial disc and the basal bulb equal to the body width (basal bulb shorter than the body wdith in B.basiri).

KEY TO THE SPECIES OF THE BASIROTYLEPTUS JAIRAJPURI,1964.

(after Siddiqi and Khan, 1964.)

1- Ovary prodelphic----------eximus Siddiqi & Khan, 1965.

Ovary apisthodelphic----------2

2- Labial disc present, terminal oesophageal bulb equal or more than the body-width long----------4

Labial disc absent; terminal oesophageal bulb less than the body width long----------3

3- Oesophagus-vulva distance about 6 times body-width; anterior uterine sac one body width long or more----------basiri Jairajpuri,1964.

Oesophagus-vulva distance about $3\frac{1}{2}$/4 times body-width; anterior uterine sac less than half body-width long----------pini Siddiqi & Khan, 1965.

4- Body size 0.62-0.90 mm; c = 74-100----------coronatus Siddiqi & Khan,1965.

Body size 0.46-0.53 mm; c = 41.8-44.2-----modestus n.sp.

Superfamily Belondiroidea Thorne,1964.

DIAGNOSIS: Dorylaimina: Moderate sized nemas ranging from 0.7-6.5 mm in length. Neck tapering to a narrow lip region which varies from rounded to angular. Amphids apertures usually about as wide as head, sometimes completely encircling lips. Spear shorter than lip region-width, with rod-like extension (flanged in Dorylaimellus). Basal portion of oesophagus surrounded by a thick sheath of spiral muscles. Tails of both sexes similar, bluntly rounded to filiform except Roqueus in which the female tail is filiform and that of male short and rounded. Single, posterior ovary present in several genera.

TYPE FAMILY: Belondiridae Thorne, 1939.

KEY TO THE FAMILIES OF BELONDIROIDEA THORNE,1964.

(After Thorne, 1964)

1- Female tail filiform, male tail blunt, rounded----------
----------Roqueidae Thorne,1964.
Tails of both sexes similar---------- ----------2

2- Vestibule with solerotization----------
----------Dorylaimellidae (Jairajpuri,1964)Thorne,1964.
Vestibule without solerotization----------3

3- Tails of both sexes bluntly rounded----------4

Tails of both sexes filiform----------

----------Oxydiridae (Jairajpuri,1964) Thorne 1964.

4- Spear axial----------5

Spear on left sub-median wall of pharynx----------

----------Nygellidae Jairajpuri,1964.

5- Body arcuate, spear extension divergent----------

----------Sydonomidae Thorne,1964.

Body straight or slightly bent, extensions parallel------

----------Belondiridae Thorne,1939.

Family Dorylaimellidae (Jairajpuri,1964)

Thorne, 1964.

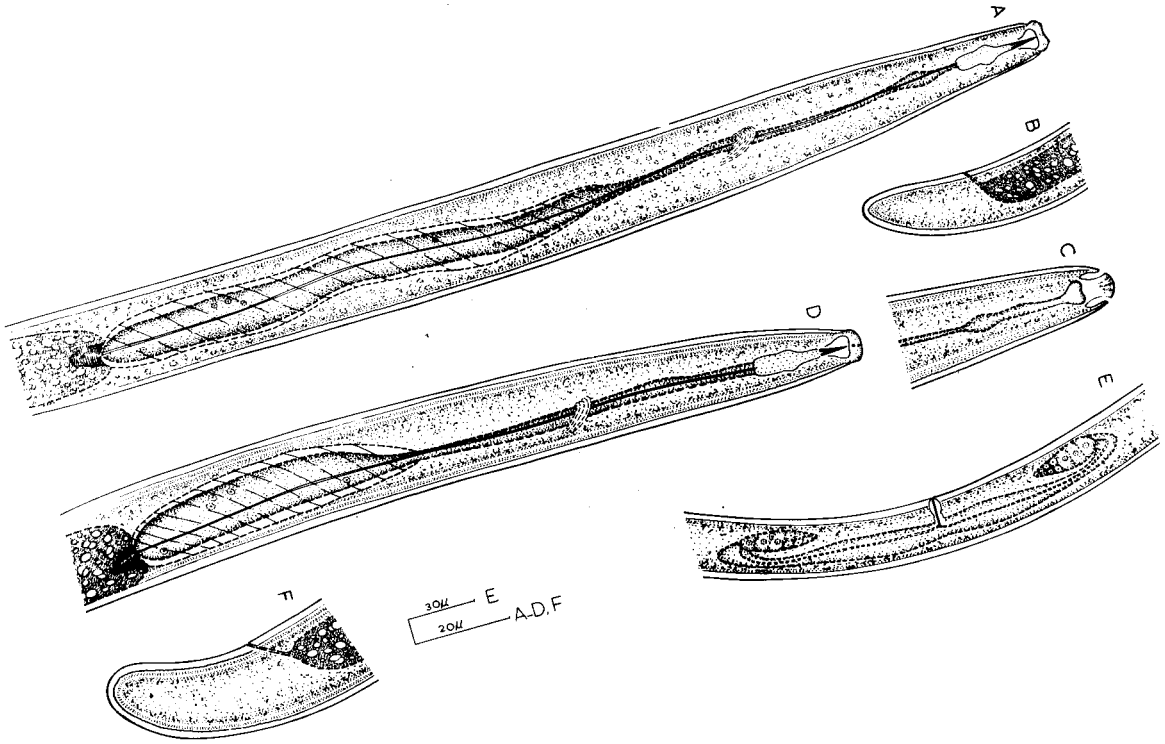
DIAGNOSIS: Belondiroidea: Tails of both sexes similar, varying from bluntly rounded to filiform. Four sclerotized pieces present about oral opening. Spear in three sections, the spear proper followed by a wider section of the extensions, then a third portion bearing three flanges reminiscent of those found in Xiphinema. Spicular massive with abrupt ventral angle. Ventro-median supplements usually arranged in pairs.

TYPE SUB-FAMILY: Dorylaimellinae Jairajpuri,1964.

Plate No. 32.

Fig. A-B. *Dorylaimellus rosanensis* n.sp. A- Head end; B- Female tail.

Fig. C-F. *Dorylaimellus pruni* n.sp. C- Head; D- Oesophageal region; E- Female reproductive region; F- Female tail.


A
B
C
D
E
F
30μ
20μ
E
A.D.F

KEY TO THE SUBFAMILIES OF DORYLAIMELLIDAE (JAIRAJPURI,1964) THORNE,1964.

1- Sclerotization of the vestibule basket-like----------

----------gwangerinae Jairajpuri,1964.

Small plates about oral opening----------

----------Dorylaimellinae Jairajpuri,1964.

Subfamily Dorylaimellinae Jairajpuri,1964.

DIAGNOSIS: Dorylaimellidae: Spear slender, extension in two obscurely separated sections which bear broad flanges. Four cuticularized pieces occur around the vestibule. Spicula very broad proximally, with an abrupt angle ventrally. Ventro-median supplements usually arranged in pairs.

TYPE AND ONLY GENUS: Dorylaimellus Cobb, 1913.

Genus Dorylaimellus Cobb,1913.

DIAGNOSIS: Dorylaimellinae: Characters of the subfamily.

Dorylaimellus pruni n.sp.

(Plate No. 32; Fig. C-F.)

FEMALES SIX: L = 1.4-1.4 mm; a = 50-56; b = 8.0-9.0; c = 46-47; V = 57-59%.
7-8 7-8

DESCRIPTION: Body twisted, assuming c-shape when relaxed by gentle heat, with most of the curvature in the posterior half of the body. Cuticle smooth, sub-cuticle striated only near head and on tail. Lateral field unusually broad nearly half as wide as body. Lip region slightly narrower than the front end of body,

1/3-1/4 as wide as body at neck base. Four sclerotized pieces present near the oral opening. Sixteen papillae present, arranged as 6+10. Spear length equal to lip region width; spear extension with distinct basal flanges, 1½ times the spear length. Amphids nearly encircling head. Hemizonid prominent. Anterior part of oesophagus slender with an spindle-shaped swelling just behind the spear extension and the posterior part enlarged, bulbar, surrounded by muscle sheath, measuring 55-60 µ in length and 10-14 µ in width, not setoff from the anterior part and nearly 2/5 of the total oesophageal length. Five gland nuclei visible in the basal bulb, dorsal gland being emptying near the anterior end of it. Cardia elongate-conoid. Intestine packed with granules. Pre-rectum more than 3½ times the anal-body width long. Rectum slightly less than 3/4 of the anal-body width.

Vulva a longitudinal slit, vagina wall not sclerotized. Ovaries asymmetrical and reflexed. Tail dorsally convex with broadly rounded terminus, 1½ times the anal-body width long. Two pairs of caudal pores present.

Males: Not found.

HOLOTYPE: Female, collected in December,1963, slide No. 1120, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of *Prunus persica* L.

TYPE LOCALITY: Dehradun, U.P., India.

DIAGNOSIS AND RELATIONSHIP: D.pruni n.sp. comes closer to D.indicus Siddiqi 1964, D.bambesae de Coninck, 1962 and D.imitator Heyns, 1963 but differs from all the three in having sub-cuticle striated near head and on tail, prominent hemizonid and unusually broad lateral field. From D.indicus it can be further differentiated in the position of vulva and in tail shape. It differs from D.bambesae in the smaller body size and from D.imitator in possessing short tail (c = 46-47) against c = 32-40 and more posteriorly located vulva.

Dorylaimellus rosanensis n.sp.

(Plate No. 32 ;Fig.I. A-B).

FEMALES TEN: L = 0.92-1.1 mm; a = 41.8; b = 3.3-4.4;
c = 31.4-39.0; v = 52.0-54.3%; spear = 6-8 µ;
spear extension = 11-13 µ.

DESCRIPTION: Body twisted, assuming open C shape when relaxed by gentle heat, with most of the curvature in the posterior half of the body, cuticle smooth, sub-cuticle finely annulated. Lip region setoff, 2/7 as wide as body at neck base. Spear equal to lip region width, slender, 6-8 µ long, with the flanged spear extension, slightly less than twice of its length. Four cuticularized pieces present around the vestibule. Amphids nearly encircling head. Oesophagus long, with usual narrow portion where it joins on to the spear extension, then slightly spindle-shaped

swelling, followed by slender non-muscular part, then enlarged in more than basal half. Cardia cylindroid. Pre-rectum two anal-body diameter long. Rectum equal the anal body width long. Tail dorsally convex, ventrally straight with rounded terminus, nearly 1¾ anal body diamter long. 30-35 lateral glandular bodies present. Ovaries paired, symmetrical and reflexed.

MALES: Not found.

HOLOTYPE: Female, collected in December, 1964 slide No.1122 deposited with the Section of Plant Pathology, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of Rosa species.

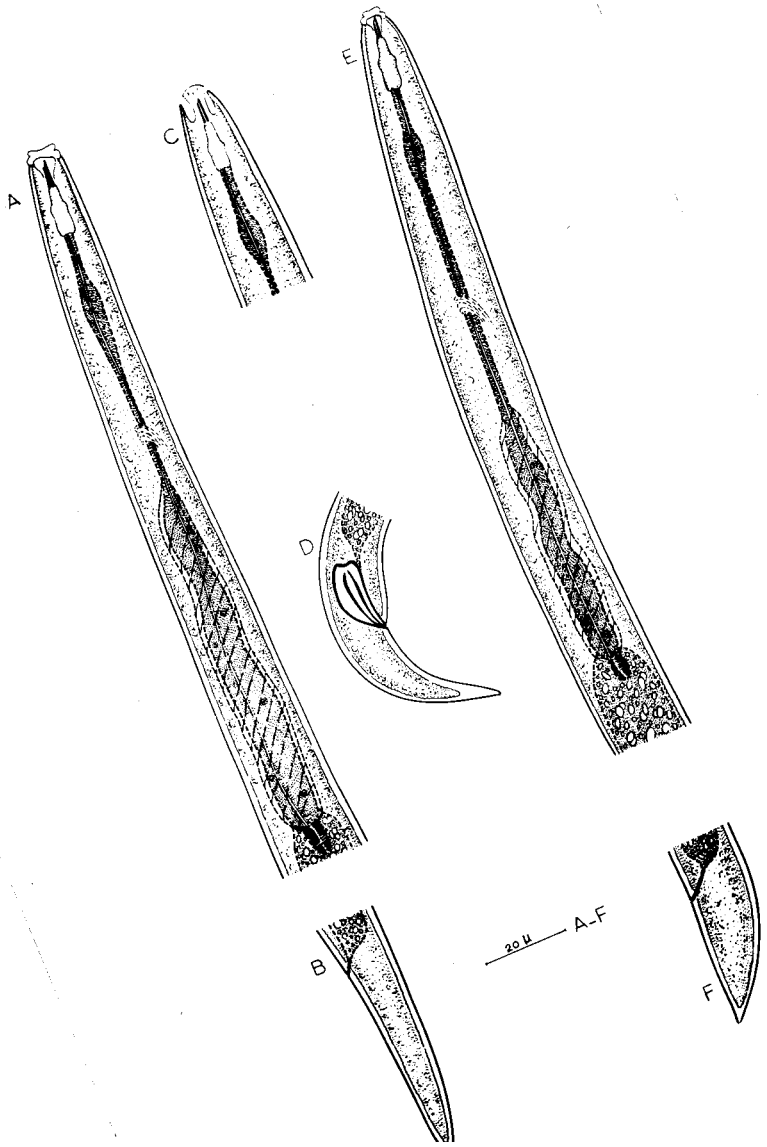
TYPE LOCALITY: University Campus, Aligarh Muslim University, Aligarh.

DIAGNOSIS AND RELATIONSHIP: D. rosanensis n.sp. comes closer to D.discocephalus Siddiqi 1964, D.vextor Heyns,1963 and D.occidentalis Thorne, 1939 but differs from (i) D.discocephalus in the absence of labial disc and cuticular annulation, it differs further in the size of the spear and spear extension and in possessing long basal bulb, (ii) D.vexator in possessing spear extension slightly less than twice the spear length, basal oesophageal bulb half or more than half the total oesophageal length and tail 1¾ anal body width long; (iii) D.occidentalis in the absence of cuticular annulation; slender body (body robust in D.occidentalis) and in possessing the rectum two times the anal body width against five times in D.occidentalis.

Plate No. 33.

Fig. A-B. *Dorylaimellus paralongicaudatus* n.sp. A- Oesophageal region; B- Female tail.

Fig. C-F. *Dorylaimellus processaus* n.sp. C- Head; D- Male tail; E- Oesophageal region of female; F- Female tail.


A
B
C
D
E
F
30 µ
A-F

Dorylaimellus processus n.sp.

(Plate No.33 ;Fig. C-F)

FEMALES TEN: L = 0.63-0.83 mm; a = 35-42; b = 4.8-5.6; c = 17.0-18.2; V = 52.0-55.5%; spear = 6.0 µ; spear extension = 12.0 µ.

MALE ONE: L = 0.69 mm; a = 46.0; b = 5.0; c = 17.0; spicules = 19.0 µ; spear = 6.0 µ; spear extension = 12.0 µ.

DESCRIPTION: Body cylindrical, ventrally arcuate on death with most of the curvature towards the posterior half of the body. Strongly twisted on tail region. Cuticle smooth, sub-cuticle finely striated. Lip region conoid, setoff, 1/3 as wide as body at neck base. Four sclerotized pieces present near the oral opening. Amphidial apertures occupying entire head width. 30-40 lateral glandular organs present. Spear short, 6 µ long, equal to the lip region width, spear extension flanged, twice the spear length. Oesophagus consists of two parts, the anterior slender part with a fusiform swelling just behind the spear extension and the posterior enlarged bulbar part, not setoff from the anterior slender part, measuring 2/5 of the total oesophageal length and surrounded by a spiral sheath of muscles. Cardia hemispheroid.

Vulva a longitudinal slit, vaginal wall not sclerotized. Ovaries paired, symmetrical and reflexed. Pre-rectum 2½-3 times the anal body diameter long. Rectum half the anal body width

long. Anus sometimes obscure due to strong twisting of body. Tail conoid with a short process ending to sub-acute terminus, more than two anal body diameter long. Two pairs of caudal pores present.

MALE: Similar to females in general shape and appearance. Testis single, spicules dorylaimoid, 19 μ long. Supplements could not be seen due to strong twisting on the tail region. Tail as in females.

HOLOTYPE: Female, collected in December, 1964, slide No.1121, deposited with the Section of Plant Pathology, Department of Botany Aligarh Muslim University, Aligarh, U.P. , India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of Justicia gendarussa Burm.

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: D.processus n.sp. comes closer to D.andrassyi Heyns, 1963 and D.digitatus Siddiqi, 1964. From the former it differs in the smaller body size, longer oesophagus and longer tail and from D.digitatus in longer oesophagus, longer tail, tail shape and in the position of vulva (V = 48.5% in D.digitatus).

Dorylaimellus paralongicaudatus n.sp.

(Plate No. 33 ;Fig. , A-B.)

FEMALES TEN: L = 0.7-0.82 mm; a = 33.5-45.0; b = 4.3-5.0; c = 17.1-18.5; v = 46.9-50.7%;spear=6-7μ;spear extension=12-13 μ.

DESCRIPTION: Body cylindrical, tapering on both extremities, much twisted towards tail. Cuticle smooth, sub-cuticle finely annulated. Lip region setoff from the body, 2/5 as wide as body at base of oesophagus. Spear 6-7 μ long, slightly less than the lip region width, its aperture occupying 1/4 of its length; spear extension distinctly flanged, 1½ times the spear length. Four sclerotized pieces present around the vestibule. Oesophagus long, with the usual narrowing at the base of spear extension, followed by a spindle shaped swelling, thence narrowing to a very slender non-muscular tube, then enlarging in less than half of the total esophageal length and this portion surrounded by a spiral sheath of muscles. Cardia elongate conoid. Intestine packed with granul Rectum nearly equal to anal body width, pre-rectum 3-4 anal body diameter in length. Tail elongate conoid, terminus rounded, its length equal to 4 to 4½ anal body diameter. Glandular organs 40-45 in number; ventral series also present, but obscure. Ovaries symmetrical and reflexed.

MALES: Not found.

HOLOTYPE: Female, collected in December 1964, slide No. 1124, deposited with the Section of Plant Pathology, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of Justicia gendarussa Burm

TYPE LOCALITY: University Campus, A.M.U., Aligarh.

DIAGNOSIS AND RELATIONSHIP: D. paralongicaudatus n.sp. comes closer to D. longicaudatus Jairajpuri, 1964 but can atonce be differentiated by possessing smooth cuticle instead of coarse annulations in the latter; spear less than the lip region width (equal to lip region width in D.longicaudatus); and prerectum 3-4 anal body diameter long against ten anal body diameter in D.longicaudatus.

KEY TO THE SPECIES OF DORYLAIMELLUS COBB,1913.

(Modified after Heyns,1963)

1- Ovary single----------2
Ovaries paired----------3

2- Ovary anterior-------aequalis (Cobb,1918) Thorne,1939.
Ovary posterior to vulva----------porosus Thorne,1939.

3- Oesophagus short(b= 6 or more)----------4
Oesophagus long (b= less than 6)----------10

4- Tail elongate-conoid, ventrally curved----------5
Tail bluntly conoid to hemispheroid----------6

5- Tail about twice anal-body width long--andrassyi Heyns,1963.
Tail about five times the anal-body width long----------
----------basiri Jairajpuri, 1965.

6- Spear with well developed flanges----------7
Spear without well developed flanges----------8

7- Spear about head-width, small sclerotized bodies present in vaginal wall----------*imitator* Heyns,1963.

Spear 3/4 head-width, small sclerotized bodies not present in vaginal walls----------*indicus* Siddiqi,1964.

8- Cuticle with transverse striae----------9

Cuticle without visible striae, sub-cuticle striated, near head and on tail----------*pruni* n.sp.

9- Body length 1.69-1.83 mm------*bambesae* De Coninck,1962.

Body length 0.67 mm ----------*digitatus* Siddiqi, 1964.

10- Anterior portion of oesophagus constricted----------11

Anterior portion of oesophagus not constricted----------12

11- Body length 0.7 mm; a = 32; c = 20 ----------

----------*nodochordus* (Cobb, in Thorne,1939)

Body length 0.92-1.1 mm; a = 42-47; c = 31-39----------

----------*rosanensis* n.sp.

12- Cuticle with prominent coarse striations----------

----------*striatus* (Cobb, in Thorne,1939).

Cuticle without prominent coarse striations----------13

13- Tail 4 x anal-body width or more ----------14

Tail less than 4 x anal-body width----------20

14- Tail clavate----------15

Tail not clavate----------16

15- Spear 4-5 µ long----------clavatus Thorne,1964.

Spear 7 µ long----------nygellurus Loof, 1964.

16- Length 1 mm or more, tail very long (c =5)----------

----------filicaudatus Thorne,1964.

Length less than 1 mm, tail not very long (c= 9 or more)

----------1

17- Tail 8 x anal-body width long----------

----------filiformis Jairajpuri,1964.

Tail less than 6 x anal-body width long----------1

18- Tail attenuated----------Spicatus Loof, 1964.

Tail not attenuated, broadly rounded----------1

19- Cuticle coarsely striated----------

----------longicaudatus Jairajpuri,1964.

Cuticle without visible striae----------

----------paralongicaudatus n.sp.

20- Tail hemispherical----------2

Tail bluntly conoid, elongate-conoid or subdigitate----------2

21- Body length over 0.8 mm ----------2

Body length under 0.6 mm ----------2

22- Labial disc present----------projectus Heyns,1962.

Labial disc absent----------longicollis Loof,1964.

23- Lateral chords with 15 pairs of glandular bodies or more---24

Lateral chords with 11 pairs of glandular bodies----------

----------Caffrae Kruger,1965.

24- Small labial disc present----------parvulus Thorne,1939.

Small labial disc absent-----Yangambiensis Germert,1962.

25- Tail sub-digitate----------26

Tail bluntly conoid or elongate-conoid----------28

26- Body length 1.4 mm ----------virginianus Cobb,1913.

Body length less than 0.84 mm ----------27

27- Oesophagus short (b = 4.8-5.6); Tail long (c=17.0-18.2);

v = 52.0-55.5 %----------processus n.sp.

Oesophagus long (b = 3.2-3.4); Tail short (c= 26-27);

v = 55-59%----------demani Goodey,1963.

28- Spear about 3/4 head width long----------29

Spear one head-width or longer----------33

29- Lip region continuous with body contour----------

----------Capitatus Siddiqi,1964.

Lip region offset----------30

30- Length about 0.8 mm or more; c = 27 or more ----------31

Length about 0.7 mm or less; c = 20-24 ----------

----------parus Jairajpuri,1964.

31- Tail tip narrowly rounded----------labiatus Thorne,1964.

Tail tip broadly rounded----------32

32- Tail ventrally convex, b = 4.0-5.5--discocephalus Siddiqi,1964

Tail ventrally straight, to concave; b = 2.9-3.6--------

----------vexator Heyns,1963.

33- Tail bluntly rounded, about 1½ times anal-body width

long----------34

Tail elongate-conoid, about twice or more body-widths long----------35

34- Body length about 0.6 mm; pre-rectum less than two anal body width long----------tenuidens Thorne,1939.

Body length about 0.9 mm; pre-rectum about five body-width long----------accidentalis Thorne,1939.

35- Body length over 0.8 mm----------graminis Kruger,1965.

Body length less than 0.8 mm ----------36

36- Oesophagus expanded in its basal half----------

----------montenegricus Andrassy,1959.

Oesophagus expanded in its basal two thirds----------37

37- Spear and spear extension 20.5-22.3 µ long----------

----------directus Heyns,1963.

Spear and spear extension about 17 µ long----------

----------monticolus Clark,1963.

Dorylaimellus cephalus Jairajpuri,1964 and D. curvatus Jairajpuri,1964 have been synonymised with D.discocephalus Siddiqi, 1964 and D.indicus Siddiqi, 1964 respectively because they resembly each other in almost all measurements, descriptions and the illustrations.

Sub-Order Alaimina (Micoletzky,1922) Clark,1961.

DIAGNOSIS: Dorylaimida: Oesophagus gradually widening to a posterior, rather pyriform bulb. 5 or 7 oesophageal gland cells present. Stoma unarmed greatly reduced (Alaimidae) or with a complex spear and guiding apparatus (Diphtherophoridae), spear either short or long, mural and only spear tip shed at moulting. Amphid openings pore-like or elliptical. Excretory pore present. Females with single or paired ovaries. Males with a single testis and no differentiated ejaculatory duct. Spicules paired, free and similar, arcuate or straight. Gubernaculum present or absent. Pre-rectum and caudal glands absent. Pre-anal supplements never paired.

TYPE SUPERFAMILY: Alaimoidea (Micoletzky,1922) Goodey,1963.

KEY TO THE SUPERFAMILIES OF ALAIMINA (MICOLETZKY,1922) CLARK,1961.

1- Stoma vestigial and unarmed----------
--------Alaimoidea (Micoletzky, 1922) Goodey, 1963.
Spear present-----Diphtherophoroidea (Thorne,1935) Clark,1961.

Superfamily Diphtherophoroidea (Thorne,1935) Clark,1961.

DIAGNOSIS: Alaimina: The spear is the combined spear and spear extension. Spear and extension short, stout and elaborate, or long and arcuate. Only the spear tip is moulted. Amphid

apertures ellipsoidal. Oesophagus a slender tube anteriorly but swelling posteriorly and gradually to a pyriform or elongate-conoid basal bulb. Pre-rectum absent. Testis single. Ventral supplements present but adanal pair absent. Gubernaculum present.

TYPE FAMILY: Diphtherophoridae Thorne,1935.

KEY TO THE FAMILIES OF DIPHTHEROPHOROIDEA (THORNE,1935)CLARK,196

1- Spear with basal knobs-------Diphtherophoridae Thorne, 1935.

Spear a mural tooth----- ----Trichodoridae Clark, 1961.

Family Diphtherophoridae Thorne,1935.

Members of this family can be recognised even under Stereomicroscope by virtue of their characteristic movements and dense intestinal contents. So far only one new species viz, Diphtherophora parva Siddiqi, 1964 has been described from India. Almost all the new species of which the description is given below have been isolated from soil around the roots of either fruit trees or ornamentals growing in localities where the soil moisture was relatively high.

DIAGNOSIS: Diphtherophoroidea: The spear is an elaborate short series of peripheral plates, rods and knobs lining the stoma. Anteriorly there is an arch-like guiding structure. Dorsal and ventral sectors of the spear are not fused but the spear extension

is tubular in section. Supplements often reduced or vestigial.

TYPE GENUS: Diphtherophora De Man, 1880.

Syn. Chaolaimus Cobb, 1893.

Archionchus Cobb, 1913.

KEY TO THE GENERA OF DIPHTHEROPHORIDAE THORNE,1935.

1- Dorsal sector of spear short, divided and well curved---
---------Diphtherophora De Man, 1880.
Dorsal sector of spear pointed, not curved or divided---
---------Tylolaimorphus De Man,1880.

Genus Diphtherophora De Man, 1880.

Syn.Choalaimus Cobb,1893.

Archionchus Cobb,1913.

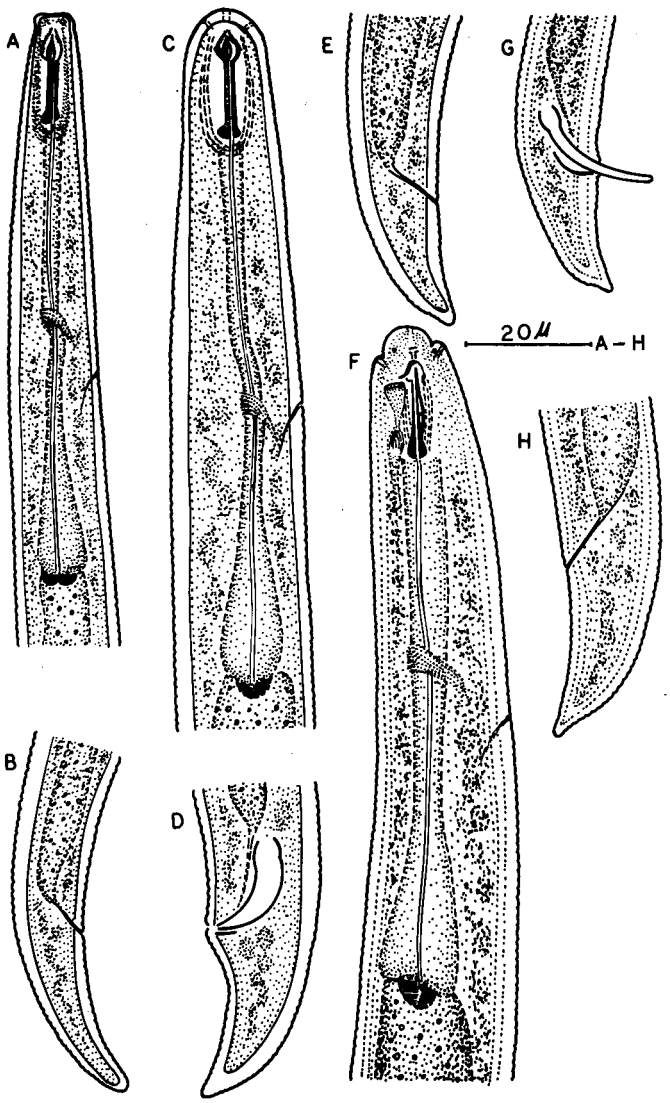
DIAGNOSIS: Diphtherophoridae: Cuticle often loosely fitting, sometimes annulated, forming membrane-like folds and shifting from side to side as the body moves. Spear guiding apparatus a complex arch-like structure which may appear to join the spear extension. The true spear (i.e. the part moulted) consists of a dorsally placed, short, pointed, curved and divided piece. Ventrally there is a very fine curved piece, not joined to the dorsal piece. Both dorsal and ventral pieces are joined posteriorly to an asymmetric

Plate No. 34.

Fig. A-B. Diphtherophora ivanovae n.sp. A- Oesophageal region; B- Female tail;

Fig. C-E. Diphtherophora granata n.sp. C- Oesophageal region of female; D- Male tail; E- Female tail.

Fig. F-G. Tylolaimorphus digitatus n.sp. F- Oesophageal region of female; G- Male tail; H- Female tail.


A
B
C
D
E
F
G
H
20 μ
A-H

tubular spear extension which has a basal swelling. Oesophagus a simple tube with a plain, pyriform or elongate-conoid basal bulb. Vulva transverse. Vagina small. Ovaries paired, opposed and reflexed. Testis single. Spicules simple, slightly arcuate. Supplements reduced or vestigial, adanal pair absent. Gubernaculum present. Excretory pore present.

TYPE SPECIES: Diphtherophora communis De Man, 1880.

Diphtherophora ivanovae n.sp.

(Plate No.34 ;Fig.A-B.)

MEASUREMENTS OF SIX FEMALES: L = 0.37-0.465 mm; a = 19-29; b = 4.3-6.0; c = 16-20; v = 48-58%; spear = 14-20 µ.

DESCRIPTION: Body cylindrical, tapering on both extremities, assuming ventrally arcuate shape on death. Cuticle and sub-cuticle striated, cuticle loosely fitted with the body except at head, vulva and anus. Lip region distinctly set-off from the body by a constriction, hemispherical. Labial papillae elevated. Spear with anterior refractive irregular part and a posterior tubular extension with prominent basal knobs, nearly 14-20 µ in length. Spear guiding apparatus irregularly sclerotized, arch-like; well developed protruder muscles of the spear attached with the spear knobs. Oesophagus with an anterior cylindrical tube encircled by

a nerve ring some where in the middle of oesophagus, slightly above the excretory pore and a posterior elongate, pyriform bulbar region. Cardia two-celled. Intestine packed with dense refractive granules. Rectum distinctly nearly half or slightly more than the anal-body width long. Tail long, conoid, not dorsally bent, with broadly rounded terminus, slightly less than three times the anal-body width long.

Vulva a transverse slit. Vagina short. Ovaries paired, opposed and reflexed.

Males not found.

HOLOTYPE: Female, Slide No. 716, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University Aligarh, U.P., India.

TYPE HABITAT: Soil around the root of Foeniculum vulgare Gaertn

This species is also collected from around the roots of Litchi chinensis Sonner and Casuarina equisetifolia L. from Vallipura and Aligarh respectively.

TYPE LOCALITY: Bijnor, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Diphtherophora ivanovae [redacted] n.sp. comes closer to D. caudata Ivanova, 1958 and D. minutus Ivanova, 1958. It differs from the former in the small body size; shorter tail which is not dorsally bent; shorter spear and the absence of males; from the latter in the shape and size of the tail, more slender body and offset head.

Diphtherophora granata n.sp.

(Plate No.34 ;Fig.C-E.)

MEASUREMENTS OF FIFTEEN FEMALES: L = 0.415-0.505 mm; a = 16.1-23.6; b = 4.5-5.3; c = 15.4-25.0; v = 53.7-63.0%; spear = 17-21 μ.

MEASUREMENTS OF SIX MALES: L = 0.38-0.45 mm; a = 16.5-20.1; b = 4.1-4.5; c = 12.6-19.8; spear= 17-21 μ; spicules = 18-23 μ; Gubernaculum = 3-4 μ.

DESCRIPTION: Body cylindrical with tapering ends, assuming slightly ventrally arcuate shape when relaxed by gentle heat. Cuticle striated, loosely fitted with the body except at head, vulva and anus. Lip region continuous with the body contour with labial papillae elevated. Amphidial pouches vase-shaped. Spear typical of the genus, surrounded by well developed protruder muscles, 17-21 μ in length. Oesophagus consisting of an anterior cylindrical tube and a posterior pyriform basal bulb. Nerve ring crosses the oesophageal tube at the level of excretory pore. Rectum distinct, slightly less than the anal-body width long.

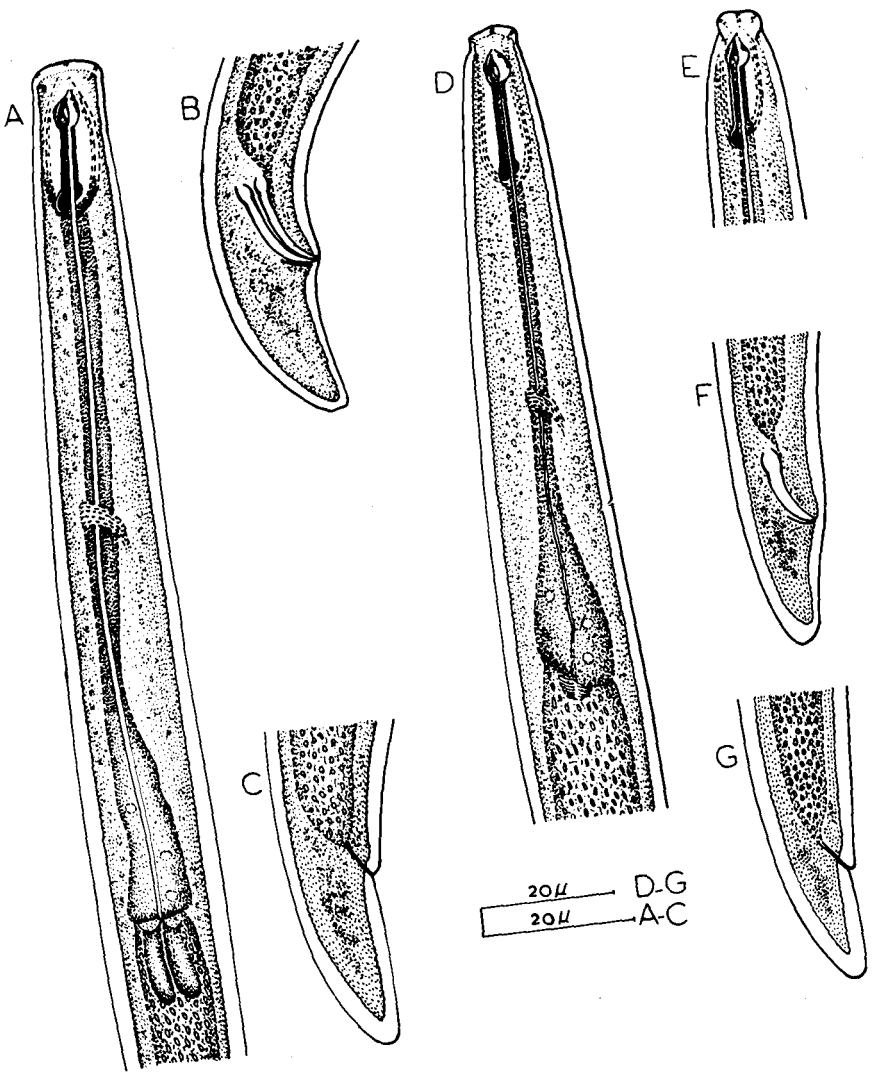
Vulva a transverse slit. Vagina short, its walls not sclerotiz Ovaries paired, opposed and reflexed. Tail dorsally covex-conoid, digitate, 1½ times the anal-body width long.

Males similar to females in general shape and appearance with comparatively smaller body size and longer oesophagus. Testis

Plate No.35.

Fig. A-C. Diphtherophora tafazzuli n.sp. A- Oesophageal region of female; B- Male tail; C- Female tail.

Fig. D-G. Diphtherophora christenseni n.sp. D- Oesophageal region of female; E- Female ~~xxix~~ head; F- Male tail; G- Female tail.


A
B
C
D
E
F
G
20μ
D-G
20μ
A-C

single,spicules paired, simple, arcuate, 18-23 μ in length. Gubernaculum short and rudimentary 3-4 μ long.

HOLOTYPE: Female, Slide No. 715, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University Aligarh, UP., India.

ALLOTYPE: Male, collected with the female; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Pome granate L.

TYPE LOCALITY: Vallipura, U.P., India.

HOSTS AND DISTRIBUTION: Collected from around the roots of Prunus persica L. and Psidium guajava L. from Vallipura and Muzaffernagar, U.P., India.

DIAGNOSIS AND RELATIONSHIP: Diphtherophora granata n.sp. comes closer to D. [illegible]ianovae Ivanova,1958 but differs from it in the presence of males, striated cuticle, size of the spear and less prominently digitate tail.

Diphtherophora Christenseni[1] n.sp.

(Plate No.35 ; Fig. D-G.)

MEASUREMENT OF ♀2 FEMALES: L=0.31-0.34 mm; a = 14-18; b = 3.4-4.0; c = 16.5-21.0; V = 58.0-60.3%; spear = 16-20 μ.

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1 Named after Late Prof. Jonas J. Christensen of the department of Plant Pathology and Physiology, University of Minnesota St. Paul, U.S.A.

MEASUREMENTS OF 5 MALES: L = 0.31-0.38 mm; a = 15.7-23.7; b = 3.8-4.4; c = 15.7-16.5; spear = 15-19 μ ; spicules = 14-1(Gubernaculum = 4-5 μ.

MEASUREMENTS OF 3 LARVAE: L = 0.27-0.29 mm; a = 14.0-15.0; b = 3.4-4.0; c = 16.0-17.0; spear = 14-15 μ.

DESCRIPTION: Body small, robust, cylindrical with tapering ends, assuming slightly ventrally arcuate shape when relaxed by gentle heat. Cuticle thick and smooth, loosely fitted with the body except at head, vulva and anus. Lip region distinctly setoff from the body by a constriction, rounded, labial papillae slightly elevated. Amphidial pouches vase-shaped. Spear typical of the genus surrounded by protruder muscles, 16-20 μ long. Oesophagus consisting of an anterior cylindrical tube and a posterior pyriform bulb, sometimes slightly overlapping ventrally. Nerve ring crossi the oesophagus slightly behind its middle. Excretory pore situate at 70-80 μ apart from the anterior end of the body. Intestine packed with dense granules. Pre-rectum not definite. Rectum disti a little less than anal-body width long. Vulva not prominent, vagina considerably short, ovaries paired, opposed and reflexed. Tail dorsally convex-conoid, not digitate, 1½ times the anal-body width long.

Males similar to females in general appearance, sometimes more curved and more slender. Testis single, spicules simple, slightly

arcuate, nearly 14-16 μ long. Gubernaculum 4-5 μ long. Tail shape as in females or slightly ventrally curved. No supplements seen.

HOLOTYPE: Female, collected on 15th December 1964, slide No.1 deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male collected with the females, other data same as for holotype.

PARATYPES: Two females and one male, slide No. 711 F & G deposited in the U.S.D.A. Nematode Collection, Betsville, Maryland U.S.A. Six females with the authors.

TYPE HABITAT: Soil around the roots of Justicia gendarussa Bu

TYPE LOCALITY: University Campus, Aligarh Muslim University, Aligarh.

DIAGNOSIS AND RELATIONSHIP: D. Christenseni n.sp. comes close to D. parva Siddiqi, 1964 and D. minutus Ivanova, 1958. It differ from D. parva in having set-off head against continuous head in D. parva, dorsally convex-conoid tail (digitate in D. parva) and in the presence of males. It can be distinguished from D. minutus in the smaller size of the body and in the position of vulva (v = 51-55% in D. minutus).

Diphtherophora tafazzuli* n.sp.

(Plate No.35 ; Fig.A-C.)

MEASUREMENTS OF SIX FEMALES: L = 0.42-0.47 mm; a = 20-25; b = 3.7-

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* Named after S.Tafazzul Husain, the father of the ~~Senior~~ author.

-45; c = 21-25; v = 62-64%; spear = 16-18 μ.

MEASUREMENTS OF 1 MALE: L = 0.4 mm; a = 30.7; b = 4.7; c = 20.0; spear 15.0 u; spicules = 18.0 μ; Gubernaculum = 6 μ.

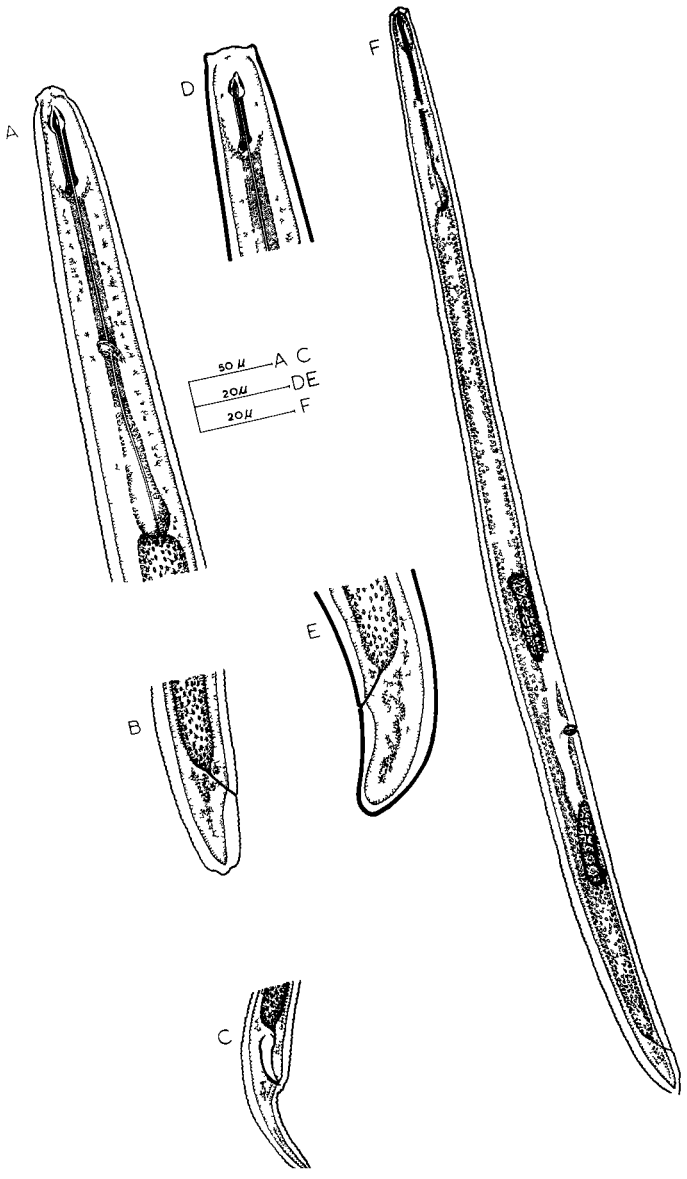
DESCRIPTION: Body cylindrical with gradually tapering ends slightly ventrally curved on death. Cuticle thick smooth and loosely fitted with the body except at head, vulva and anus. Lip region continuous with the body, angular and flat; labial papillae distinctly elevated. Spear with anterior refractive irregular part and a posterior cylindrical extension with prominent basal knobs, nearly 16-18 μ long; spear guiding appara irregularly sclerotized, arch-like; well developed, protrudor muscles of the spear attached with the knobs. Oesophagus with an anterior cylindrical tube crossed by nerve ring somewhere in the middle and a posterior bulbar region, pyriform in shape. After the cardia two glandular organs are seen. Intestine packed with refractive granules. Rectum distinct nearly ½ the vulvar-body width long. Pre-rectum not definite. Tail dorsally convex-conoid, not digitate, 1½ times anal-body width long. Ovaries paired, opposed and reflexed. Vulva not prominent, vagina short, its walls not slerotized.

Males similar to females in general shape, more slender than females. Tail nearly similar to females, slightly more conical at the terminus. Testis single; spicules simple, slightly arcuate, 17 μ long. Gubernaculum present, nearly 6 μ long. No supplements seen.

Plate No. 36.

Fig. A-C,F. *Diphtherophora mangiferi* n.sp. A- Oesophageal region of female; B- Female tail; C- Male tail; F- Female.

Fig. D-E. *Diphtherophora citri* n.sp. D- Head of female; E- Female tail.


A
B
C
D
E
F
50 µ
A C
20µ
DE
20µ
F

HOLOTYPE: Female, collected in January 1964, slide No. 712 deposited with the Plant Pathology Section, Department of Botany Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Cestrum diurnum L.

TYPE LOCALITY: University Campus, Aligarh Muslim University, Aligarh.

DIAGNOSIS AND RELATIONSHIP: D.tafazzuli n.sp. comes closer to D. parva Siddiqi, 1964, D.minutus Ivanova, 1958 and D. christenseni n.sp. but differs from all in possessing two glandular organs at the base of oesophagus, just after the cardia Further it differs; I- From D. parva in the position of vulva (V = 57-59% in D. parva) presence of an abnormal structure associated with the basal oesophageal bulb, shape of the female tail end in the presence of males. II- From D. minutus in body width, tail length, position of vulva (v = 51-55% in D.minutus) and in the presence of males. III- From D. christenseni n.sp. in the body size and width, position of vulva (v = 62-64% in D. christenseni) and in the continuous head (set-off in D.Christenseni).

Diphtherophora citri n.sp.

(Plate No. 36 ; Fig. ,D&E)

MEASUREMENTS OF 6 FEMALES: L = 0.45-0.64 mm; a = 21.7-27.8;

b = 4.2-4.5; c = 20.0-25.6; v = 60.0-64.0%; spear = 15.0-19.

DESCRIPTION: Body cylindrical, tapering gradually on both extremities, slightly ventrally curved on death. Cuticle thick, smooth and loosely fitted with the body except at head, vulva and anus. Lip region continuous with the body contour. Labial papillae distinctly elevated. Amphidial pouches vase-shaped. Spear typical of the genus guided by well developed protrudors muscles attached to the spear knobs. Oesophagus consisting of an anterior cylindrical tube, encircled by nerve ring near its middle, and a posterior pyriform basal bulb. Intestine packed with dense granules. Pre-rectum not definite; rectum prominent nearly $\frac{3}{4}$ anal-body width long. Tail broadly convex-conoid, $1\frac{1}{2}$ times the anal-body width long. Ovaries paired, opposed and reflexed. Vulva not distinct, vagina short, its walls not sclerotized.

Males not found.

HOLOTYPE: Female, collected in May 1964 slide No. 713 deposited with the Plant Pathology Section, Department of Botany Aligarh Muslim University, Aligarh, U.P., India.

TYPE HABITAT: Soil around the roots of Citrus medica L.

TYPE LOCALITY: Dehra Dun, U.P., India.

DIAGNOSIS AND REIATIONSHIP: D.citri n.sp. is related to D.kirjanovae Ivanova, 1958, D. pseudoperplexans Van der Linde,193

D. perplexans Cobb, 1913 and D. pellucidus (Cobb,1893) Thorne,19 It differs from the first in the position of vulva, body-width and tail length and from the last three in the position of vulva and tail length.

Diphtherophora mangiferae n.sp.

(Plate No. 36 ; Fig. A-C and F)

MEASUREMENTS OF 3 FEMALES: L = 0.44-0.45 mm; a = 20-21; b = 4.0-4.5; c = 21-23; v = 57.5-58.5%; spear = 21-22 µ.

MEASUREMENTS OF 1 MALE: L = 0.32 mm; a = 21.0; b = 4.7; c = 14.3; spear = 18.0 µ; spicules = 13 µ; Gubernaculum = 4µ

DESCRIPTION: Body cylindrical tapering at both extremities, slightly ventrally arcuate on death. Cuticle and sub-cuticle striated. Lip region narrow than front end of body, setoff from the body contour. Labial papillae elevated. Amphidial pouches vase-shaped. Stylet typical of the genus. Corpus a cylindrical tube ending in a pyriform basal bulb. Cardia rounded. Intestine packed with granules. Pre-rectum not definite, rectum distinct nearly ½ the vulvar-body width long. Tail nearly round, 1½ times the anal-body width long. Ovaries paired, opposed and reflexed. Vulva not prominent. Vagina short, ¼ of the vulvar-body width; vaginal muscles forming a globular structure around i

Rounded spermathecae present with rod-shaped sperms.

Males similar to female with the tail shape entirely different, convex-conoid, tapering uniformly towards the posterior end ending in a rounded terminus. Testis single; spicules simple, slightly arcuate, measuring 13 μ long. Gubernaculum 4 μ in length. No supplements seen.

HOLOTYPE: Female, collected in October 1964, slide No. 714 deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Mangifera indica L.

TYPE LOCALITY: Ghazipur, U.P., India.

DIAGNOSIS AND RELATIONSHIP: D.mangiferi n.sp. comes closer to D. parva Siddiqi, 1964 D.minutus Ivanova, 1958 and D.tafazzuli n.sp but differs from all the above three in possessing annulated body cuticle and sub-cuticle. Further it differs (i) from D. parva in the setoff head, shape of the female tail, larger spear and in the presence of males, (ii) from D. minutus in the position of vulva (V = 51-55% in D.minutus) body-width and tail length and (iii) from D. tafazzuli in the position of vulva and set-off head (head continuous in D. tafazzuli).

KEY TO THE SPECIES OF DIPHTHEROPHORA de Man 1880.

(Based on females only)

1- Average body length 500 µ or less ----------2

Average body length 570 µ or more----------8

2- Tail convex-conoid, digitate----------3

Tail convex-conoid to nearly rounded, not digitate------5

3- Oesophagus short (b = 4.5-5.3); Males known----------

----------granata n.sp.

Oesophagus long (b = 3.7-4.7); Males not known---------4

4- Body length 360-420 µ; Amphids vase-shaped with flattened-oval amphid apertures D.parva Siddiqi, 1964.

Body length 490-520 µ; Amphids oval, elongated vertically----------D.kirianovae Ivanova, 1958.

5- V = 48-58%----------15

V = 57.5-64 ----------6

6- Head continuous with the body contour; v = 62-64%--------

----------D. tafazzuli n.sp.

Head setoff from the body contour; v = 57.5-60.5%--------7

7- Body length 310-340 µ; cuticle and sub-cuticle smooth----

----------D. christenseni n.sp.

Body length 440-460 µ; cuticle and sub-cuticle striated--

----------D. mangiferi n.sp.

8- Tail not bent dorsally, less than two times the anal-body width long; v = 50-64%----------9

Tail bent dorsally, more than two times the anal-body width long; v = 48-51% ----------

----------D.caudata Ivanova, 1958.

9. Oesophageal enlargement subcylindroid to cylindroid-----

----------D.vanoyei de conick,1931.

Oesophageal enlargement pyriform, elongate-conical or rounded----------10

10. Cuticle striated--------D. pseudoperplexans v.d. Linde, 1938.

Cuticle smooth----------11

11- Neck short, b = 6 or more; v = 54%; c = 33, ----------

----------D.brevicolle Thorne,1939.

Neck longer, b = 5 or less; v = 56-64%; c = 12.0-25.6-----

----------12

12- Tail length equal to anal-body width; a = 11; ----------

----------D. obesus Thorne, 1939.

Tail length nearly twice or more than anal-body width; a = 21.3-27.8----------13

13- Cuticle very thick, forming membrane-like folds----------

-----D.pellucidus, D.perplexans Cobb, 1893 and 1913.

Cuticle not forming membrane-like folds----------14

14- L = 0.75 mm; c = 12-15; v = 56%; tail elongate conoid bent dorsally, males known---------- ---------- D. communis de Man,1880.

L = .0.45-0.64 mm; c = 20.0-25.6; v = 60-64%; tail nearly rounded, not bent dorsally, males not known----------D.oitri n.sp.

15- Head offset; tail long elongate conoid with broadly rounded terminus----------ivanovae n.sp.

Head continuous; tail conical with bluntly rounded terminus----------minutus Ivanova,1958.

Genus Tylolaimorphus De Man,1880.

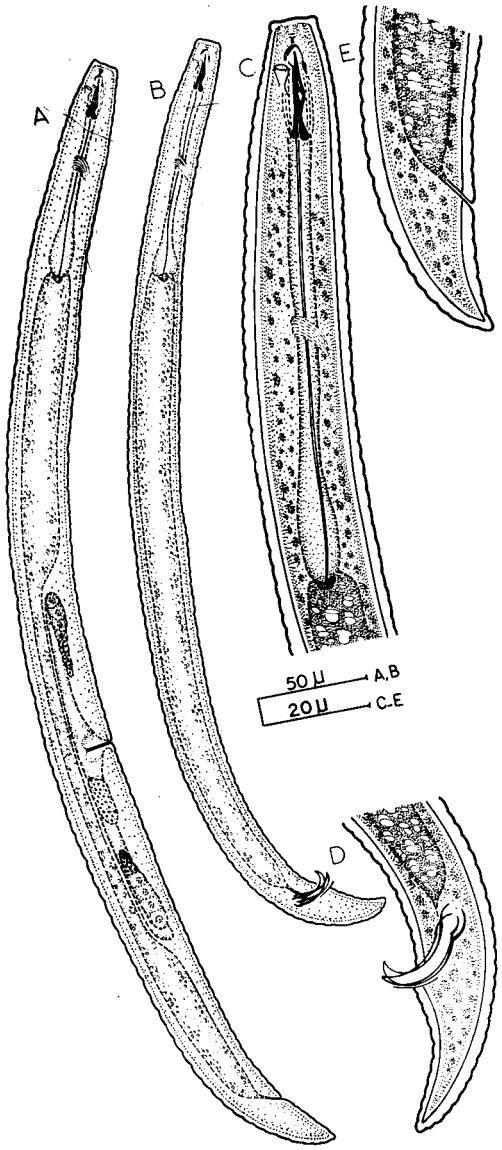
Syn. Triplonchium Cobb, 1920.

No species of this genus has so far been reported or described from our country. The author has two new species of this genus in his collection. This is the first report of this genus from India.

DIAGNOSIS: Diphtherophoridae: Body contents very dense, often obscuring details. Spear and extension tubular in section, the dorsal and ventral sectors not fused anteriorly, base of extension knobbed, dorsal sector somewhat widened and pointed. Spear guiding apparatus a complex, arched structure attached to

Plate No.37.

Fig. A-E. *Tylolaimorphus indicus* n.sp. A- Female; B- Male; C- Head end of female; D- Male tail; E- Female tail.


A
B
C
E
D
50 µ
A,B
20 µ
C,E

a short tubular section. Amphid apertures ellipsoid, amphids elongate with sensillae separated from them by a short tube. Basal oesophageal bulb pyriform. Vulva transverse; vagina connected with the elongated uterine sac which is sometimes upto 8 body widths long. Ovaries paired, opposed and reflexed. Spicules arcuate or semicircular, ventrally concave supplied with spiral protruder muscles. Supplements vestigial.

TYPE SPECIES:- Tylolaimorphus typicus De Man,1880.

Tylolaimorphus indicus n.sp.

(Plate No. 37;Fig. A-E.)

MEASUREMENTS OF SIX FEMALES: L = 0.41-0.50 mm; a = 18-23; b = 4.6-5.1; c = 14.7-22.3; v = 51.8-58.1%; spear = 18-21 μ.

MEASUREMENTS OF ONE MALE: L = 0.415 mm; a = 21.3; b = 3.9; c = 14.8; spear = 18 μ; Spicules = 25 μ ; Gubernaculum = 10 μ

DESCRIPTION: Body cylindrical, ventrally arcuate on death. Cuticle loosely fitted with the body except at head, vulva and anus. Lip region continuous with the body contour, labial papillae elevated. Spear typical of the genus, guided by well developed protruder muscles. Anterior portion of oesophagus cylindrical crossed by nerve ring somewhere below its middle. Excretory pore located below the level of nerve ring. Basal

oesophageal bulb pyriform. Cardia conoid. Intestine packed with dense granules. Rectum distinct, opening through a prominer anal aperture, nearly half the anal-body width long. Tail convex-conoid, digitate.

Vulva transverse. Vagina at right angles to the body axis leading into the body slightly more than half of the vulvar body width and surrounded by a globular area of muscles. Ovaries paired, opposed and reflexed.

Males similar to females in general shape and appearance with comparatively longer oesophagus. Testis single, reflexed. Spicules paired, cephalated, arcuate 25 μ in length. Gubernaculum simple, 10 μ long. Tail shape as in females.

HOLOTYPE: Female, slide No. 720μ deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim Universit Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females, other data same as for holotype.

TYPE HABITAT: Soil around the roots of Hibiscus rosa-sinensis

TYPE LOCALITY: University Campus, A.M.U. Aligarh.

DIAGNOSIS AND RELATIONSHIP: Tylolaimorphus indicus n.sp. differs from all the known species in the smaller body shape size and shape of the spicules.

Tylolaimorphus digitatus n.sp.

(Plate No. 34 ;Fig. F-H.)

MEASUREMENTS OF THREE FEMALES: L = 0.36-0.44 mm; a = 16.0-18 b = 4.1-4.6; c = 14.0-20.0; v = 52.7-65.0%; spear = 16-17 μ.

MEASUREMENTS OF ONE MALE: L = 0.35 mm; a = 21.9; b = 5.1; c = 17.5; spear = 13 μ; spicules = 23 μ; Gubernaculum = 8 μ.

DESCRIPTION: Body cylindrical, ventrally arcuate when relaxed by gentle heat, tapering on both extremities. Cuticle loosely fitted with the body except at head, vulva and anus. Lip region rounded, set-off from the body by a deep constriction Labial papillae not prominently elevated. Spear typical of the genus, 16-17 μ in length, guided by well developed protruder muscles. Anterior portion of oesophagus a slender tube crossed by nerve ring below its middle. Basal oesophageal bulb spindle-shaped. Cardia hemispheroid. Intestine packed with dense granules. Rectum short, 3/4 anal-body width long. Tail convex-conoid digitate, nearly twice the anal-body width long. Two pairs of caudal pores present.

Vulva transverse. Vagina at right angles to the body axis leading into the body less than 1/3 vulvar-body width and

surrounded by a globular area formed by the muscles around it. Ovaries paired, opposed and reflexed. Oocytes arranged in a single row.

Males similar to females in genera shape and appearance with more slender body, longer oesophagus and smaller spear. Testis single, reflexed. Spicules paired, ventrally arcuate, cephalated, with rounded lip and guided by muscles, 23 μ in length. Gubernaculum simple, 8 μ long. Tail shape as in female

HOLOTYPE: Female, slide No. 721, deposited with the Plant Pathology Section, Department of Botany, Aligarh Muslim University, Aligarh, U.P., India.

ALLOTYPE: Male, collected with the females; other data same as for holotype.

TYPE HABITAT: Soil around the roots of Prunus persica L.

TYPE LOCALITY: Rampur, U.P.

DIAGNOSIS AND RELATIONSHIP: Tylolaimorphus digitatus n.sp. comes closer to T.indicus n.sp. but differs from it in possessin offset head, smaller average body size, size of the spear and the shape of the spicules.

KEY TO THE SPECIES OF TYLOLAIMORPHUS D Man,1880.

1- Body size small not more than 0.5 mm ----------2

Body size 0.6 mm or more ----------3

2- b = 4.1-4.6; L = 0.36-0.44 mm; spear = 16-17 µ;
Head offset----------digitatus n.sp.
b = 4.6-5.1; L = 0.41-0.50 mm; spear = 18-21 µ;
Head continuous ----------indicus n.sp.

3- Head sharply offset cap-like-----pileatum Andrassy, 1961.
Head continuous or slightly offset, not cap-like-------
----------4

4- Body size 0.6 mm ----------minor Thorne,1939.
Body size 0.8 mm or more ----------5

5- Body size 0.8 mm ----------typicus De Man, 1880.
Body size more than 1 mm ----------6

6- Only males are known; pre-anal papillae five and two post-anal----------bulgaricum Andrassy, 1958.
Both (male and female) are known; pre-anal papillae One and post-anal-none -------cylindricum Cobb,1920.

Tylolaimorphus rotundicauda Paesler,1955 could not be included in the key due to unavailability of literature.

S U M M A R Y

This Thesis deals with taxonomy of the soil and plant parasitic nematodes found around the roots of a variety of crops from different parts of India. In all 54 species representing 27 genera belonging to 12 families and 2 orders have been described. Of these 53 species, one subgenus and two genera are new to the Science. They are listed below:-

1. Tylenchus (Ottolenchus) equisetus n.subgen., n.sp.
2. T. (Lelenchus) cynodontus n.sp.
3. T. (L) majus n.sp.
4. Psilenchus raski n.sp.
5. Ditylenchus minutus n.sp.
6. D. ausafi n.sp.
7. D. cyperi n.sp.
8. Pseudhalenchus minutus Tarjan, 1958.
9. Paurodontus saxeni n.sp.
10. P. chowdhuri n.sp.
11. Nothotylenchus taylori n.sp.
12. Boleodorus typicus n.sp.
13. B. Hyderi n.sp.
14. B. rafiqi n.sp.

15. Basiliophora indica n.gen., n.sp.

16. B. jonesi n.gen., n.sp.

17. B. longicaudata n.gen., n.sp.

18. Ecphyadophora goodeyi n.sp.

19. E. tarjani n.sp.

20. E. acuta n.sp.

21. E. graminis n.sp.

22. E. vallipuri n.sp.

23. Rotylenchus helicus n.sp.

24. Rotylenchulus stakmani n.sp.

25. Hemicycliophora dhirendri n.sp.

26. Heterodera mothi n.sp.

27. Meloidogyne goldeni n.sp.

28. Aphelenchoides chinensis n.sp.

29. A. absari n.sp.

30. A. jacobi n.sp.

31. A. andrassyi n.sp.

32. Seinura nagini n.sp.

33. S. oostenbrinki n.sp.

34. Paraphelenchus saccchari n.sp.

35. Tylencholaimus clavicaudatus n.sp.

36. Thornedia solani n.gen., n.sp.

37. Enchodorella mustafi n.sp.

38. Longidorella minutissima n.sp.

39. Tylencholaimellus thornei n.sp.

40. Dorylaimoides leptus n.sp.

41. D. elongatus n.sp.

42. Basirotyleptus modestus n.sp.

43. Dorylaimellus rosanensis n.sp.

44. D. processus n.sp.

45. D. paralongicaudatus

46. D. pruni n.sp.

47. Diphtherophora imanovae n.sp.

48. D. granata n.sp.

49. D. christenseni n.sp.

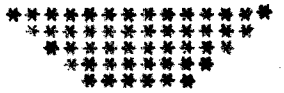
50. D. tafazzuli n.sp.

51. D. citri n.sp.

52. D. mangiferi n.sp.

53. Tylolaimorphus indicus n.sp.

54. T. digitatus n.sp.



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